EXHIBIT 7-B

35 consecutive days, 52 ovens were pushed every day from Block No. 1 at Chicago, and for 23 days before that at least 49 ovens were pushed every day. At the end of this period the output was somewhat reduced, due to lack of demand for coke. The average chimney pull during that period was 26 millimeters and the average gas pressure 6½ centimeters. The best record ever made on Block No. 3 at Milwaukee was during the 8 days from Aprl 7 to April 14, inclusive, 1908, when 48 ovens were pushed each day, giving a coking time of 20 hours, or 1½ hours longer than Block No. 1 at Chicago. The coke from Block N. 3 at Milwaukee was not thoroughly coked, whereas it was at Chicago Block No. 1. The coal coked at Chicago was 60% Boomer and 40% Smokeless, while at Milwaukee it was about 50% of each. The volatile in the Chicago coal was about 25.5%, while at Milwaukee it was about 24.5%. While this difference in mixture and per cent. of volatile would somewhat affect the ease of coking, the effect would not be anywhere near sufficient to cause 1½ hours longer coking time. A very similar mixture of the same coals has been regularly coked in 16½" silica ovens at Detroit in 16¾ hours. During this time the average chimney pull at Milwaukee was 38 millimeters and the average gas pressure 14 centimeters; thus the gas used was much larger than the amount of gas used at Chicago. The engineering design, construction and operation of this block of ovens by M. C. & G. Co. has caused and continues to cause a great waste of S. S. Co.'s gas.

Gas for Heating Ovens After Rebuilding or Repairs—Query: What does the contract say about repairs? Section 8: "The Coke Company agrees * * * * at all times to keep said premises in good repair and condition." The fuel for heating up ovens after rebuilding or repairs is just as much a material required as the brick or other material used in the repairs. Hence it is included in M. C. & G. Co.'s obligation to "furnish all labor and material for the operation of said plant and **pay therefor.**" (Section 6 of contract.)

The entire 160 ovens were heated, after rebuilding, with gas belonging to S. S. Co., 20 ovens were relined the second time, and 118 other ovens were taken off for repairs during 1907, making 298 ovens reheated. Calculations of the gas consumed show that it required at least 227 M. feet of gas per oven to heat them after repairs, requiring a total of 67,646 M's, which, at 10c per M., would make $6,764.60 of gas burned by M. C. & G. Co., for which S. S. Co. received no return. Henceforward M. C. & G. Co. should pay to S. S. Co. $22.70 for gas for heating up an oven after it has been cooled down for repairs, and should now pay $6,764.60 plus interest at 6 % for S. S. Co.'s gas burned in heating up the ovens after rebuilding and repairs. Appendix "C" shows the amount of repairs and consequent reheating of ovens. (Charge for gas for heating other ovens in 1906 after May 1st, and in 1908 to March 31st, will be

computed as soon as the data is available.) While the figure of 10c has been tentatively employed in calculating the amount that M. C. & G. Co. should pay for excess gas used or for gas which M. C. & G. Co. has failed to produce, it is legally entitled to damages for the entire **value** of the gas to it. M. C. & G. Co. knows that S. S. Co. can receive as high as 19c per M. feet, and the value of the gas to S. S. Co. is 19c less the cost of enrichment.

Gas Burned Under Boilers. During the years 1906 and 1907 large quantities of S. S. Co.'s gas were actually burned under the boilers by M. C. & G. Co. Mr. Schlesinger clearly recognized that the M. C. & G. Co. had no right to do this, and after urgent requests by S. S. Co. issued oral instructions to Mr. Greim to stop the practice. It is impossible to give an estimate of the amount of gas burned under the boilers, but our records of the number of hours that gas was burned in large quantities per hour through 3 inch burners show that an enormous amount of gas must have been burned. This practice has been nearly stopped, though even 1908 shows some gas so burned in January and February.

Gas Burned in Flues to Reduce Boiler Fuel: Always during the operation of M. C. & G. Co. large quantities of S. S. Co.'s gas have been burned in the oven flues not necessary for the coking of the coal but simply to reduce the fuel cost of the M. C. & G. Co. This condition is proved by frequent inspection by S. S. Co.'s representatives, repeated protests to M. C. & G. Co. by S. S. Co. and by Mr. Greim's statement made in the presence of Messrs. Schlesinger, E. L. Pierce and Witherby in Milwaukee, in December, 1907.

Mr. Greim's claim was that the reason why his surplus gas yield is lower now than it was when he was operating the plant in 1905, is that he is now burning gas in the flues to reduce his fuel. His claim in regard to it is that he is entitled to do this on account of the fact that Mr. Davis did it during the time that he was running the plant for S. S. Co.

As shown in the early pages of this section, M. C. &G. Co. has absolutely no right to use S. S. Co.'s gas for any purpose whatever without paying therefor, unless in return for a fair interpretation of the contract on other lines S. S. Co. concedes to M. C. & G. Co. the right to use simply for coking the coal the gas necessary, when used in the most economical manner.

Mr. Greim claims that S. S. Co. did not equip the plant with sufficient auxiliary boiler capacity to maintain steam consumption without the use of gas. The plant was designed by S. S. Co. as a unit for handling a certain coal tonnage. M. C. & G. Co. raised the ovens to 5-high, thereby destroying the balance between the various parts of the plant. The waste heat boilers were designed to handle the waste heat from 4-high ovens; this they were able to do, passing all of the waste gases through the boilers and extracting heat therefrom. With the 5-high ovens more gas is burned so that the waste gases cannot all be passed through the boilers without too great reduction

in the chimney pull—a condition aggravated by the change to 5-high, since 5-high ovens require higher chimney pull than 4-high. In order, therefore, to get enough pull for the 5-high ovens M. C. & G. Co. raises the by-pass dampers, allowing waste gases to go around the boilers to the stack and thus the heat in the waste gases is not fully utilized. This throws more work on the auxiliary boilers, causing an increased consumption of fuel by M. C. & G. Co., which they try to lessen by burning S. S. Co.'s gas under the claim that S. S. Co. did not provide sufficient boilers.

The raising of the ovens from 4-high to 5-high, moreover, increases the fuel requirements of the plant. More coal is to be handled and pulverized, more gas to be exhausted, more water pumped, more liquors distilled, etc., etc., so that while a certain boiler capacity was sufficient for 4-high ovens, it became inadequate when the work of the plant was increased 30%.

The present auxiliary boilers, moreover, are running at less than their maximum capacity, because they are burning refuse coke breeze, which is a cheap fuel but which reduces the boiler capacity compared with coal. If the M. C. & G. Co. wishes to reduce its auxiliary boiler capacity by the use of such fuel, it should install sufficient boiler capacity, at no expense whatever to S. S. Co., to supply the needs of the plant when using that fuel. M. C. & G. Co. state that the City authorities will not allow the burning of tar and soft coal as S. S. Co. did. The fact is that the City ordinance regarding Smoke Prevention is the same now as when S. S. Co. operated the plant. All that is necessary is that sufficient boilers, and properly arranged, should be installed so that the smoke will be consumed and not create black or gray clouds of smoke for more than six minutes after firing. That this condition is by no means prohibitive is shown by the large use of soft coal by other manufacturing establishments in Milwaukee. This is all the more reason why M. C. & G. Co. should increase its auxiliary boiler capacity.

A further feature of M. C. & G. Co.'s burning of the gas in the flues to reduce its fuel expense, is that this gas is so inefficiently burned that there is waste of S. S. Co.'s gas without even the contemplated gain to M. C. & G. Co. This condition was clearly shown when S. S. Co.'s foreman, Mr. Biehl, went to Milwaukee last winter. So much gas was being used in the flues by M. C. & G. Co. that it was not being burned, and hindered the combustion of the gas that should have been burned. The ovens were getting cold and M. C. & G. Co. argued that the way to heat them was to turn on more of S. S. Co.'s gas, in the same way that a gas stove gives more heat when more gas is turned on. This shows the absurdity of M. C. & G. Co.'s methods of operation. What the ovens needed was not more gas but less. Biehl turned off a large amount of the gas and the ovens became hotter, because he secured proper combustion of the requisite amount of gas.

Cold Air for Ovens: M. C. & Co. has changed over its entire oven operation to the use of cold air for combustion instead of using the preheated air method supplied by S. S. Co. It is a well-known fact that hot air for combustion reduces the amount of gas required for coking the coal. M. C. & G. Co. took this step because it had allowed the sole flues of the ovens to get in such bad repair that when running on hot air the waste gases from the ovens were chilled by the air leaks in the sole flues, so that they did not supply the same amount of steam under the waste heat boilers as when running on cold air. The chimney pull was impaired and the gas combustion became inefficient. In June, 1907, the waste gas showed as high as 8 and 10% excess oxygen (40 to 50% excess air). The same condition obtained in February, 1908. The leakage of air from the sole flues to the waste gas flues is increased on Block 3 by the fan which gives an abnormally high suction. The ovens should at once be restored to firing with hot air, such repairs being made to sole flues as may be required. The sole flues were in good condition on May 1st, 1906, and have been allowed by M. C. & G. Co. to become very leaky. The leakage has been increased by M. C. & G. Co. by rapidly shutting down and starting up the ovens during the change to 5-high. At the time of this change repairs were made to almost no sole flues. It is S. S. Co.s practice at gas-making plants to take up the oven floors after shutting down a block of ovens and repair the sole flues. This has recently been done in the case of Block No. 1 at Detroit.

M. C. & G. Co. may claim that the practice of using cold air was introduced by S. S. Co.s representative, Mr. Biehl, and that the use of cold air resulted in reduction of gas consumption. This is true; but it is only true because the M. C. & G. Co. had allowed the sole flues to get out of repair, and was adopted as a temporary expedient to reduce the excessive gas consumption. The practice of stopping off the main air arches, moreover, is a dangerous one, since the heat not being removed by the air may cause damage to the foundation under the ovens.

Burning Gas to Heat Gas Pipes: A matter of somewhat minor importance is M. C. & G. Co.s burning S. S. Co.'s gas to reduce its own expense in connection with keeping clean the gas pipes to the oven burners. On account of the fact that M. C. & G. Co. at the time it raised the ovens from 4-high to 5-high reduced the C. G. capacity, the quality of the gas has been made inferior, the tar and naphthalene not being properly removed, so that stoppages of the small gas pipes occurred in winter. Instead of providing sufficient condensing capacity to condense the gas so that it would be of proper quality to pass through these pipes, or putting on labor to keep the pipes clean, M. C. & G. Co. burned large quantities of S. S. Co.'s gas at these pipes in a very wasteful manner in spite of frequent requests by S. S. Co. that the practice be stopped.

Gas Yields: Appendix "D" shows the coal mixtures and gas yields for the first six months of 1905, as compared with the M. C. & G. Co.'s operation of the plant. In 1905 Mr. Greim obtained 3,100 feet per ton of dry coal, in spite of frequent interruptions to the oven operation and actual burning of considerable gas under the boilers. The percentage of low volatile coal was higher then than during the years 1906 and 1907, when much lower yields were obtained, and was about the same as during the early part of 1908, when the yield is still very low. Mr. Greim states that the reason for this reduction in yield is the burning of S. S. Co.'s gas to reduce the fuel cost of M. C. & G. Co. This and other important reasons have been fully stated above. It has been claimed that under S. S. Co.'s operation during the second six months of 1905, S. S. Co. did not obtain as high a yield as during the first six months. This is true. During more than the first half of this period Mr. Greim was in charge of the plant, and his failing health, which culminated in his going to the hospital in October for a protracted illness, was partly responsible for the poor work at the plant during that period. The gas yield dropped to an average of 2,310 feet per ton dry coal for average of August, September and October; the ammonia yield fell off; the repairs at the plant were grossly neglected so that the plant was in bad condition in many departments. When Mr. Davis took hold in October it was necessary to do an extraordinary amount of repair work and the operation was interrupted by construction work on the second 80 ovens.

M. C. & G. Co. claim that S. S. Co. is negligent in watching the gas yield, as shown by allowing the meter readings and candle powers to be taken by the Milwaukee Gas Light Company. This is untrue. M. C. & G. Co. knows, by its copy of the contract between S. S. Co. and the Milwaukee Gas Light Company, that the measurement of the gas is to be in the meters of the M. G. L. Co. For the first three years of gas delivery these meters were tested every three months. They have not been tested for about six months, on account of the large gas deliveries last winter from the heavy coal tonnage due to the 5-high ovens. Another meter is being installed and the old meters will shortly be tested, and all will be regularly tested in future. As for M. C. & G. Co.'s insinuation regarding candle power readings not receiving proper attention by S. S. Co., the readings are made each day, except Sunday, jointly by M. G. L. Co.'s man and M. C. & G. Co.'s man, who is employed by S. S. Co. to look after S. S. Co.'s interests. Often a S. S. Co. man reads also. The readings by the various men check very closely; on Sundays the readings are usually taken only by M. G. L. Co.'s man, but the Sunday readings show no lower candle power than the week days. M. C. & G. Co. claims that there is a 10% leakage and condensation between the coke ovens and the point of measurement at Third ward. This is untrue. The leakage of gas in Milwaukee

street mains is one of the lowest of any City in the U. S. A leakage of any considerable amount would be immediately detected by the odor and the pipe would be repaired. The condensation in the line amounts to less than 2,000 M. per month, or less than 2% of the gas volume. For the past six months Chicago has averaged over 3,200 feet per ton coal, while Milwaukee has averaged 2,500. It would require an increase of 28% to bring the Milwaukee yield up to that of Chicago, an amount impossible to account for by leakage and condensation.

Comparing the gas yields at Milwaukee for the past six months with those at Chicago and Detroit for the same period (see Appendix "D"), the great loss of S. S. Co.'s gas due to the causes hereinbefore mentioned is shown very clearly. The kinds of coal used at the three plants are the same, although the mixture at Milwaukee contains somewhat more Smokeless than at the other two plants. This difference in mixture would nowhere near account for the great difference in yields. M. C. & G. Co. has claimed that at Detroit and Chicago the gas is measured nearer the plants and that leaks and condensation occurring at Milwaukee between the ovens and the meters put Milwaukee at a disadvantage. As shown above, this could not possibly account for the great volume of gas per day that S. S. Co. should receive at Milwaukee over what it is now receiving, to compare favorably with Detroit and Chicago. The difference is in the burned coal used and the very unsatisfactory operation at Milwaukee.

Attention to Gas Combustion: This condition is the determining factor in the excessive use of gas for the ovens. While the organization on the plant has shown improvement in many ways during the two years that M. C. & G. Co. has been operating it, there is still a weakness on the part of the organization which conducts the burning of the gas in the flues.

This question of organization is one of the important features of the unsatisfactory by-product returns from the plant. Even if the coal were satisfactory, and the plant kept in proper shape, the organization is such that the best results would not be obtained. This is rarely the fault of the men actually doing the work, many of whom are excellent men doing their best to get results. The difficulty is that the M. C. & G. Co.'s manager has not the capacity for handling an organization and training it so that it will deliver the best results. This condition has been so clearly demonstrated during his operation of the plant under S. S. Co.'s management and since then under M. C. & G. Co.'s management, that it is necessary to state clearly that under his management it is exceedingly doubtful if the plant, however well equipped with apparatus, could deliver the by-product results to which the S. S. Co. is entitled.

Procedure: M. C. & G. Co. should pay S. S. Co. $6,764.60 plus interest at 6% for S. S. Co.'s gas burned by M. C. & G. Co. in

heating up ovens after changing to 5-high and rebuilding and repairing, and henceforward should pay S. S. Co. $22.70 for gas each time an oven is heated up after repairs or changes. M. C. & G. Co. should immediately repair, at its own expense, with no charge to S. S. Co., the sole flues that leak sufficiently to interfere with the oven operation and use of preheated air. The burning of S. S. Co.'s gas to reduce fuel expense of M. C. & G. Co. should cease. If M. C. & G. Co. finds the reduction in gas burned necessitates an additional auxiliary boiler, this should be installed at once by M. C. & G. Co., with no expense whatever to S. S. Co. Henceforward, no gas whatever should be burned under boilers by M. C. & G. Co. without paying S. S. Co. suitable price for gas so burned.

VII.

GAS PRODUCTION.

Burned Coal: One of the principal factors in causing the unsatisfactory yield of gas at Milwaukee is the fact that burned and heated coal has been charged into the ovens in large quantities, as explained in detail under section "Burned Coal."

Ovens: Block No. 3 was reconstructed by M. C. & G. Co. of silica brick, making a thinner wall than used by S. S. Co., and these ovens leak very badly. The leakage is increased by the abnormally high suction carried in the flues of this block by means of a fan installed without the approval of S. S. Co. They have now been in run over six months, and if the leaks were likely to make up with carbon this would have occurred long ago. The leakage is especially bad at the door frames and in the top flues. To show how extraordinaily bad these leaks are, it was observed on April 18th, 1908, that one oven had the regular gas supply cut off entirely from the top flues for ten hours after the oven was charged and more gas leaked into the flue than could be burned with the regular air supply. This gas being the first or richer portion is the most valuable portion for illuminating purposes, and all of the tar, ammonia and light oil in it was burned and lost. Nearly all the ovens in this block leak so much that the gas supply is cut off the top flues and frequently other flues, or even all the flues, for three or four hours after charging, the leakage of the most valuable gas supplying the gas for coking. Extensive repairs to this block will be necessary to make it operate satisfactorily. With only six months' operation it has been necessary to repair six ovens on account of the unstable construction having allowed the bottom flues to be pushed in.

Ovens Filled Too Full: In the attempt to make the 5-high ovens coke per day the amount of coal they were estimated to coke, the M. C. & G. Co. operation has filled the ovens too full. This does not allow sufficient escape of the gas to the hydraulic main and has increased the leakage of gas with loss of by-products. When after

repeated requests by S. S. Co. the charges were reduced to normal in January, 1908, the loss of by-products, especially gas, was notably diminished.

Pushing Ovens Too Soon: On account of the bad operation of the ovens by M. C. & G. Co., the coal oftentimes is not completely coked and an attempt is made to increase the output of the plant by pushing the coke before it is coked. Last fall when attempting to increase the coke capacity of the plant, the coke was oftentimes pushed before it was completely coked, and emitted a cloud of smoke or gas when pushed, which meant a loss of by-products to S. S. Co., and poor coke for M. C. & G. Co.

Regularity of Pushing and Charging: Regularity of pushing, and prompt charging and luting are essential details of good oven operation which have been greatly neglected by M. C. & G. Co., to the loss of S. S. Co.'s by-products.

Hydraulic Mains: It requires the closest attention by the S. S. Co. to prevent the M. C. & G. Co. operators from cutting off ovens from the hydraulic mains long ahead of their time of pushing, thus allowing the by-products to escape into the air, sometimes for hours before the ovens are pushed. The same attention is necessary by S. S. Co. to prevent long waste of by-products into the air due to delay in putting the ovens onto the hydraulic mains after charging. These matters are now much improved so that the regular practice cuts off three or four ovens ahead of pushing, and puts the ovens more promptly onto the mains, but the moment the S. S. Co. vigilance is relaxed these features are neglected with consequent loss to S. S. Co. The condition at present is much relieved by the slow rate of pushing. When the plant is running up to speed these features are uniformly neglected. S. S. Co. pays M. C. & G. Co. to do this work satisfactorily, and if M. C. & G. Co. fulfilled its contract obligation this work would be attended to properly after once being called to M. C. & G. Co.'s attention.

B. H. Valve Cleaning: The B. H. valves have often been very badly neglected by M. C. & G. Co., and have required a great amount of attention from S. S. Co. to keep them even in reasonably good condition. When these valves are allowed to become foul there is a very bad leakage between the rich and lean systems, which reduces the benefit of the gas separation.

B. H. Valve Changing: S. S. Co. has had great difficulty to make M. C. & G. Co. keep the proper ovens on the rich gas system, to obtain proper gas separation. This feature shows improvement, but still requires the closest attention from S. S. Co. to insure proper work.

B. H. Regulators: One of the most important features of a successful oven operation is the maintaining of proper control of the back pressure on the B. H. If the pressure is too great, gas leaks from the ovens; if too small, air is drawn into the ovens, destroying

coke and by-products. We have, at a number of plants, B. H. regulators in successful operation which accomplish this work automatically and with much greater regularity and nicety than is possible by hand regulation. They were in operation on Blocks 3 and 4 up to the time of the fire in May, 1906, and they had been purchased and were on the ground for Blocks 1 and 2. Mr. Greim declined to allow them to be installed. Immediately after the fire they were removed from Blocks 3 and 4. S. S. Co. has repeatedly asked to have the regulators restored; Mr. Greim refused to do this, because he claimed that they were a source of danger from fire. This argument is superficial, since, with reasonable care, to prevent leakage, they are not an important source of danger. In the years that S. S. Co. has operated them at various plants only one fire has occurred in any way due to their use, and that a small one. Mr. Greim objects, also, that they require expert attention; this is true only to a very limited amount, and shows his attempt to reduce his operating cost at the expense of S. S. Co. In November, 1907, Mr. Greim consented to put a man on each butterfly to regulate the pressure by hand. A man was stationed all the time on each B. H., and even then the regulation was not as good as by the regulators, and the labor cost more than any attention that the regulators would require. During months of S. S. Co.'s repeated requesting Mr. Greim to restore the B. H. regulators, he claimed they were of no value and refused to put them on. In October, 1907, finding that we had in successful operation an electric regulator at Chicago, Mr. Greim agreed to build some for Milwaukee. This work was so delayed that none was installed until March, 1908, and then only one; while the remainder have at last been ordered, there will probably be much delay in obtaining them. The regulators could have been put on many months sooner, if they had not been delayed for refinements, which were absolutely unessential and which have increased their cost to the benefit of neither M. C. & G. Co. nor S. S. Co. In regard to the regulators on the old ovens which were damaged by the fire in 1906, the M. C. & G. Co. clearly violated Section 9 of the contract, regarding insurance. Mr. Greim claimed that the regulators were destructible by fire, hence subject to the insurance clause. They were partly destroyed by the fire, and while the insurance money should have been used to replace them "as speedily as possible," they have not been restored practically two years after the fire. It was not until March 1st, 1906, that recording charts were put on the hydraulic mains, although they had been repeatedly asked for by S. S. Co. and M. C. & G. Co. had consented to this installation April 17, 1907—a delay of a year. A marked improvement occurred as soon as these were put on. This subject of B. H. control is discussed at length, because it has been a source of great and entirely unnecessary loss to the S. S. Co., and has shown a deliberate violation of the contract (Clause 9) and the attitude of

M. C. & G. Co.'s operation toward protecting the S. S. Co.'s interests in the by-products.

Gas Separation: Gas separation ceased at the time of the fire, May, 1906. After months of urgent request by S. S. Co. that gas separation be restored, this was finally done in January, 1907, eight months after the fire. There was no reason whatever why gas separation could not have been started long before. At the present time the gas separation is not as good as it should be, due partly to the leaky valves. Mr. Greim states that it is due to leaks in the baffle plate separating the two sides of the B. H. If this is true, the M. C. & G. Co. should immediately repair such leaks. The use of identically the same system at other plants gives satisfactory separation and there is no ground whatever for Mr. Greim's claim that for satisfactory separation it is necessary to have two entirely separate B. H.'s, or collector pipes. It would be a waste of money to throw out these B. H.'s until their value has been worked out by longer service.

Gas Pipe—B. H.'s to C. G.'s: One of the features of the S. S. Co.'s installation which was severely criticised by Mr. Greim was the size of the gas pipes leading from the B. H.'s to the C. G.'s on the north two blocks. He claimed that they should be considerably larger. Attention is called to the fact that when the ovens were increased to 5-high, these pipes which Mr. Greim said were already overloaded had their work increased 25% and no enlargement of them has been made by M. C. & G. Co.

Condensers: When the ovens were raised from 4-high to 5-high, no increase whatever was made in the condensing capacity at the plant to handle the 25% increase in gas; in fact, this capacity was reduced by the three condensers formerly in the B. P. building which have been thrown out. The condensers are not now needed in the B. P. building, due to the different type of scrubbers used; but they are needed outside, and Mr. Greim said that he would install them outside. This promise has never been fulfilled. While the condensing surface for the rich gas is about normal, that for the lean gas is entirely inadequate, and we are suffering loss of light oil by the rapid condensation. The improperly condensed gas has caused stoppages in the gas mains with burning of S. S. Co.'s gas to keep the pipes clean at the oven burners. Noted fully under Gas Consumption. The improperly condensed gas caused stoppage of the pipe to the City, so that it was impossible to deliver to the City all the gas available and loss to S. S. Co. resulted. Moreover., the naphthalene deposited in that pipe absorbs L. O. from the gas, thus reducing its c. p. and the revenue from it to which S. S. Co. is entitled. Mr. Greim promised to relieve this situation somewhat, by running a gas pipe from the north condensers to the south condensers for better distribution of the load. This has never been done. The condensing capacity should be immediately increased at

no expense whatever to S. S. Co., by the installation of the equivalent of eight outside condensers, to stop the loss of by-products.

Loss After Fire, May, 1906: Due to very great changes not approved by S. S. Co. in apparatus and B. P. building after the fire of May, 1906, the exhauster restoration was very much delayed, the gas was not properly exhausted from the ovens, and great and unnecessary loss of S. S. Co.'s gas resulted. M. C. & G. Co. claimed that their action in letting by-products be lost in order to hasten the completion of the changes in building and apparatus was for the ultimate advantage of S. S. Co. To this view S. S. Co. was always actively opposed.

Quality of Gas: On account of using burnt coal and the unsatisfactory operation of ovens and B. H.'s, the quality of the gas sent to the City is such that the enrichment of it for illuminating purposes is very expensive, and it has been impossible during winter months to deliver as high candle power gas as should be possible, and the S. S. Co.'s revenue has thereby been reduced.

Relations to Gas Company: The irregularities in quantity of output of gas have been a source of expense and great inconvenience to the Milwaukee Gas Light Company, to whom the S. S. Co. delivers the gas, so that S. S. Co. has suffered in its relations with the Gas Light Company. The Milwaukee Gas Light Company has repeatedly stated that it realized the difficulty that the S. S. Co. had in securing proper gas operation from M. C. & G. Co., and has been liberal in its construction of the gas contract and has been of much assistance to the S. S. Co. in its effort to work out the gas delivery problem under the unsatisfactory oven operation. The unsatisfactory gas operation by M. C. & G. Co. has reflected against the reputation of the S. S. Co. as a gas delivering company.

Penalties on Gas Delivery: In spite of the liberal construction of the contract by the Milwaukee Gas Light Company, it has been necessary for S. S. Co. to pay penalties for failure of gas delivery by M. C. & G. Co.'s operation in the amount shown in Appendix "C," of which the total has been $2,906.44 during M. C. & G. Co.'s operation since May 1, 1906, whereas the total penalties during S. S. Co.'s operation were only $159.40.

Control of Gas Apparatus: In spite of the vigilance of the S. S. Co. in attempting so to control the operation of the gas recovery apparatus that the difficulties in gas delivery might be reduced to a minimum, occasional difficulty has been caused by interference on the part of M. C. & G. Co. For example, it has been their practice, when ammonia scrubbers became foul with naphthalene, to turn the rich gas through the lean scrubbers to remove the naphthalene, thus saving labor to M. C. & G. Co. at the expense of S. S. Co. This causes the naphthalene to be deposited in the gas line to the City. This has been done repeatedly, a notable instance of which occurred in April, 1908, when without notifying S. S. Co. Mr. Greim ordered

this to be done. The next day the condensates from the gas-main exceeded the enriching oil added and the candle power of the gas dropped considerably. While orders have now been issued by Mr. Greim against this practice, it is an example of the losses the S. S. Co. sustains due to the operation being carried on without the Company actually paying the men having a financial interest in the results of the by-product operation.

Procedure: The contract requires M. C. & G. Co. to keep the plant in repair. They should therefore immediately repair the leaky ovens, especially in Block No. 3, and pay for the gas required for heating the ovens again after repairs, as shown under "Gas Consumption." M. C. & G. Co. should not fill the ovens too full; should not push them before the by-products have been driven off; should not cut them off from the hydraulic mains too long before pushing; should keep the gas valves and uptake pipes properly cleaned. M. C. & G. Co. should immemdiately install regulators for the hydraulic mains. M. C. & G. Co. should immediately increase the gas pipes from the B. H.'s to the C. G.'s on the north two blocks, and should immediately add the equivalent of eight outside condensers. M. C. & G. Co. should henceforward operate the entire condensing and scrubbing plant as the S. S. Co. may direct. The above additions and changes should be made by the M. C. & G. Co. with no expense whatever to S. S. Co.

VIII.

AMMONIA RECOVERY.

Burned Coal: One of the principal factors in causing the unsatisfactory yield of ammonia at Milwaukee is the fact that burned and heated coal has been used to a large extent as explained under the section entitled "Burned Coal."

Ovens: There has been and continues to be loss of ammonia due to leakage into the flues of the ovens. This is much worse on Block No. 3, designed and built by M. C. & G. Co., than on the other blocks. The leakage is increased by the very high suction used on this Block, caused by the installation of the fan. This leakage has been explained more in detail under "Gas Production."

B. H. Regulators: The lack of B. H. regulators has caused unnecessary leakage of gas from the ovens into the flues and into the atmosphere, and has also allowed air to enter the ovens, causing destruction of ammonia by the high temperature caused by local combustion of gas, light oil, tar and coke.

Losses After Fire: S. S. Co. sustained very heavy and unnecessary losses of ammonia after the fire in May, 1906, due to the protracted period of reconstruction. The clause in the contract, stating that after a fire the apparatus shall be "restored as speedily as possible," was clearly violated. A great amount of changing of building

and of apparatus not approved by S. S. Co. was undertaken which very much delayed the restoring of the by-product apparatus so that S. S. Co. sustained a heavy loss while paying full operating charge and rental. Throughout this reconstruction the M. C. & G. Co. insisted that in the long run the S. S. Co. would suffer less if the by-products were neglected and the final installation pushed forward to completion. With this position S. S. Co. always disagreed, and the action of M. C. & G. Co. was in violation of the express request of S. S. Co. that by-product apparatus should be fitted up and put in run before the completion of large amounts of other construction work which could have been delayed without serious loss to anybody.

Lowering of L. G. E. Overflows: A test made jointly in the summer of 1907, by S. S. Co., Western Gas Construction Co. and M. C. & G. Co. showed the necessity of lowering the overflows of the L. G. T.'s to make them efficient. One has been done, but not even tested. This work should be resumed at once.

Ammonia Scrubbers: It has been the opinion of S. S. Co., stated in writing and also orally many times to M. C. & G. Co., that when they changed the ovens from 4-high to 5-high they should install more ammonia scrubbers. This they have, so far, refused to do. They stated that sufficient scrubbing capacity would be obtained by changing the L. G. M.'s, or preliminary scrubber boxes, into two-compartment instead of one-compartment. That this would give sufficient scrubbing capacity S. S. Co. has never believed nor accepted. S. S. Co., however, agreed to allow the change of one, and if a test on it proved to effect sufficient increase in capacity, the others would be changed. This arrangement was made early in July, 1907. One L. G. M. was changed, but after nine months' delay, it has not even been tested out to determine its capacity. S. S. Co. therefore insists that the L. G. T. capacity be increased by cutting down the overflows, and if this does not give sufficient capacity one more L. G. T. be installed with no expense whatever to S. S. Co., in order to provide sufficient scrubbers for the change to 5-high ovens.

Scrubber Operation: Although the operation in the B. P. building has been subject to a certain amount of supervision by S. S. Co., it has been found that when the vigilance of the S. S. Co.'s representatives is in any way relaxed, the result is unsatisfactory control of the water supply and other features in the scrubbing operation, and loss of ammonia results. It has been customary, also, for M. C. & G. Co. to clean the scrubbers of naphthalene by turning the rich gas through them, carrying along into the City gas pipe the naphthalene which causes loss to S. S. Co., in order to save labor to M. C. & G. Co. This unsatisfactory operation in the B. P. building is not the fault of the men directly performing that work, since they are in general good men and working as well as they can under the unsatisfactory organization. The trouble is that the head

of the operating organization has not sufficient realization of the necessity of continuous attention to the many details of by-product operation, hence loss of S. S. Co.'s by-products.

Decanters: When the ovens were increased from 4-high to 5-high, no increase in decanter capacity was installed by M. C. & G. Co., and the capacity of decanters is now below the standard amount installed by S. S. Co. The result is that the tar contains more than the standard amount of water, and this water contains ammonia which is a loss to S. S. Co. M. C. & G. Co. should immediately install sufficient decanters for a satisfactory decanter operation at no expense whatever to S. S. Co., and they should receive the necessary attention for operation satisfactory to S. S. Co.

A. C. Plant: The work in the A. C. building has been directly under the control of S. S. Co., and has been quite satisfactory. The losses in this building are small. S. S. Co. will continue to exercise this control over that operation. No increase whatever in the ammonia concentration apparatus was made by M. C. & G. Co. when the ovens were changed from 4-high to 5-high. The apparatus is barely able to handle this increase, and when repairs are necessary the apparatus is pushed so hard that there is considerable danger of loss of ammonia. While S. S. Co. is willing for the present to allow this operation to continue without the installation of a third ammonia concentrator or A. C. apparatus, it is quite likely that when the plant runs up to speed it may be found necessary to install another apparatus. If this becomes necessary, it should be installed by M. C. & G. Co. at no expense whatever to S. S. Co.

Storage: When the ovens were increased from 4-high to 5-high, no increase in storage of either weak or strong liquor was made. This increases the danger of loss of ammonia. M. C. & G. Co. should install at least 25% more capacity of storage of weak or strong liquor, if at any time S. S. Co. finds that such is necessary to prevent loss. S. S. Co. is willing for the present that no increase should be made, but retains the right to require the additional storage if desired.

Yield of Ammonia: While S. S. Co. has sustained serious losses of ammonia in the past due to the unsatisfactory operation by M. C. & G. Co., there has been considerable improvement during the past four or five months so that the yield is more nearly satisfactory than it has been at any time under M. C. & G. Co.'s operation. The yield, however, is not yet satisfactory, as shown by the fact that it is materially below the yields obtained at Detroit and Chicago on the same kinds of coal with a slightly different mixture, and by the fact that the losses noted above are occurring.

Procedure: M. C. & G. Co. should immediately, and without any expense whatever to S. S. Co., repair the leaks in the ovens, particularly Block No. 3; they should install B. H. regulators; they should lower the overflow in the present L. G. T.'s not so equipped,

and if this is not sufficient they should install another L. G. T. and such decanters and such apparatus in the ammonia concentrator building as may prove to be necessary. If found advisable, additional storage should be installed. It is clearly the obligation of the M. C. & G. Co. to employ for every department in which the ammonia work is concerned, in any way, such an organization as will carry out the instructions of S. S. Co. without the necessity of unceasing vigilance of S. S. Co. in watching every detail to see that its instructions are carried out. S. S. Co. employs M. C. & G. Co. for this work and pays them for it.

IX.

TAR RECOVERY.

Conditions which have been explained at length under "Gas Production" have caused, and continue to cause, loss of S. S. Co.'s tar, due to unsatisfactory installation and operation by M. C. & G. Co., namely, burned coal, leaks in ovens, especially Block No. 3, B. H. regulation, C. G. capacity, and loss during reconstruction due to unnecessary delay in restoring exhausters. The details of these are therefore omitted at this point.

Water in Tar: Due to the unsatisfactory installation and operation by M. C. & G. Co., the water in the Milwaukee tar is higher than it should be, and this has given the Milwaukee tar a bad reputation on the market as compared with other tars.

Storage Capacity: The storage for tar at Milwaukee was only large enough for 4-high ovens. When the ovens were increased to 5-high, this storage capacity became inadequate, increasing the water in the tar shipped; increasing the difficulties with the Barrett Manufacturing Company to obtain sufficient car supply; possibility of loss of tar due to inadequate storage. M. C. & G. Co. should immediately install, at no expense whatever to S. S. Co., considerable additional tar storage.

Tar Yield: The tar yield under M. C. & G. Co.'s operation has never averaged as high as the yields at Detroit and Chicago, on similar coal of a slightly different mixture. It is possible that tar is destroyed in the hydraulic mains at Milwaukee, as compared with Detroit, or that it is lost due to insufficient condensation, and S. S. Co. may find it advisable to alter the operation for improvement of the tar yield.

Procedure: As stated under the ammonia and gas operations, the use of burned or otherwise deteriorated coal should be stopped and such other changes made as S. S. Co. may deem advisable in order that the tar operation may be improved as far as possible.

X.

LIGHT OIL RECOVERY.

The L. O. operation by M. C. & G. Co. has been and continues to be unsatisfactory at Milwaukee. As explained under the gas and ammonia operations, conditions of installation and operation reducing other by-products have reduced the L. O. yield, by the use of burned and otherwise deteriorated coal; by the leaks in the ovens, especially in Block No. 3; by inadequate B. H. regulation, which has allowed both loss of L. O. from the ovens and allowed entrance of air, which has destroyed L. O. in the ovens; and by the lack of sufficient condensers, so that the gas is not satisfactorily condensed and L. O. is lost.

Fire: The loss of S. S. Co.'s L. O. in the period succeeding the fire of May, 1906, was exceedingly heavy, and the contract requirement that apparatus should be restored "as speedily as possible" was grossly violated. In spite of the repeated protests and requests of S. S. Co., M. C. & G. Co. refused to do the small amount of work necessary to complete the piping of the second scrubber, which was on the ground and erected for a long time before it could be put in run, M. C. & G. Co. preferring to finish piping and unnecessarily elaborate building construction before doing this work for the recovery of L. O. It was not until May 7, 1907, or within two weeks of one year after the fire, that sufficient L. B. T. capacity had been installed, even to pass all the gas to be scrubbed for L. O. Up to that time a large portion of the gas had to be by-passed around the recovery apparatus and the L. O. in this gas was entirely lost.

The difference in yield between May and June, 1907, and the period from June, 1906, to April, 1907, constituted a loss to S. S. Co. of over 100,000 gallons of L. O., which, at the market price of 11c per gallon, was worth $11,000 to S. S. Co. If the plant had been simply restored after the fire, instead of very much enlarged and changed along lines not approved by S. S. Co., the L. O. could undoubtedly have been completely recovered, commencing with November 1st, 1906, which, even at the low yield obtained during May and June, 1907, would have amounted to 85,764 gallons, which at 11c per gallon was worth to S. S. Co. $9,434, as shown in Appendix "E." The contract states in Section 6, that the S. S. Co. shall pay for the L. O. from outside sources "when sufficient L. O. **cannot** be produced at the plant." With proper attention, this L. O. could have been obtained at Milwaukee, and therefore M. C. & G. Co. should pay for the $9,434 worth of L. O. lost by their negligence during this period. This is based on the low yield of .91 gallons per ton, which is much below what S. S. Co. has the right to require. M. C. & G. Co. was frequently and persistently requested by S. S. Co. to take advantage of the opportunity to recover this oil, but no action was taken. It required seven weeks simply

to erect the second L. B. T., which should have been done in a few days.

C. G.'s: As noted under "Gas Recovery," M. C. & G. Co. has not provided sufficient condensing capacity for the additional tonnage due to changing the ovens from 4-high to 5-high, and this occasions loss of L. O. in the tars from the C. G.'s. It is impossible to determine the amount, but modern gas works practice is in accordance with this theory.

This inadequate condensation, moreover, causes the absorption oil to become less efficient for the removal of the L. O. from the gas, so that L. O. passes the scrubbers unabsorbed and is lost to S. S. Co.

L. B. T.'s or Light Oil Scrubbers: The L. B. and L. B. T. provided by S. S. Co. for the 4-high ovens were worked to their full capacity for that amount of gas. When the ovens were raised to 5-high, no increase in L. B. T. capacity was provided by M. C. & G. Co., and loss of L. O. has resulted. Another L. B. T. is essential for the proper recovery of the L. O. in the gas, and this should be immediately installed without any expense whatever to S. S. Co.

Light Oil Plant: In the L. O. plant itself no increase in apparatus was provided by M. C. & G. Co. for the additional tonnage when the ovens were changed from 4-high to 5-high. The L. O. plant was already worked nearly to its capacity on the 4-high ovens, and an increase in capacity is necessary for complete recovery. This matter was presented to M. C. & G. Co. over one year ago, and efforts were made to secure an increase in capacity. M. C. & G. Co. refused to make the increase and S. S. Co. provided, at its own expense, a cooling apparatus, in the effort to reduce the loss of L. O. caused by inadequate capacity. After one year of urgent request M. C. & G. Co. has at last arranged to install certain changes in the L. O. plant, to take care of the L. O. from the increase in coal tonnage. This should be installed in accordance with the instructions of S. S. Co. If this apparatus now arranged for proves to be inadequate, more should be installed by M. C. & G. Co. promptly, at no expense whatever to S. S. Co.

Storage: When the ovens were increased from 4-high to 5-high, the M. C. & G. Co. made no increase in the storage capacity for L. O. It has been necessary for S. S. Co., at expense to itself, to keep on rail at Milwaukee a large portion of the time tank cars to supplement the L. O. storage, in order to provide for the possible necessities of the plant. M. C. & G. Co. should immediately install at no expense whatever to S. S. Co., at least 25% more L. O. storage.

Procedure: M. C. & G. Co. should immediately install, without expense to S. S. Co., another L. B. T., 8 C. G.'s, B. H. regulators, and the necessary increase in the L. O. Plant for proper handling of the L. O., and at least 25% more L. O. storage capacity. M. C. & G. Co. should stop the use of burned and otherwise deteriorated coal, and should so operate the ovens, hydraulic mains, other by-product

recovery apparatus, and L. O. operation as will as much as possible reduce the losses of L. O. resulting from M. C. & G. Co.'s inadequate installation and unsatisfactory operation.

XI.

YIELDS—FIRST SIX MONTHS 1905.

During the first six months of 1905, the Milwaukee plant was operated by the Semet-Solvay Company with Mr. O. F. Greim as superintendent. During this period the by-product yields were reduced to a considerable extent by inefficient exhausters, which allowed large loss of gas. These exhausters were replaced by S. S. Co. at its own expense. Shortage of steam also occurred until S. S. Co. completed its arrangements for burning tar and coal under the waste heat boilers. Frequent shortages of water occurred on account of inadequate well water supply, and a pumping station at the river was erected.

The coal used was a mixture of 52% Boomer and 48% Smokeless, all of which had been stored on the ground since the preceding season, except a small amount used in June. A good deal of this coal had been on the pile since the summer of 1903, and showed extensive weathering; some of it had been heated in storage so that by-products had been lost. These conditions show that the operation during that period was by no means ideal; actual losses occurred, so that these yields are not quoted as representing what would be satisfactory yields at Milwaukee, but simply to show what was obtained on the plant designed, built and operated by S. S. Co. Mr. Greim has made the statement that the plant of 80 ovens at that time in operation was very badly designed. There were certain faults in design, and neglect in operation, but even under that condition the plant produced results. The great expenditure of money made during the past two years by M. C. & G. Co. has not resulted in improvement of the by-product yields, but in making them worse, with the single exception of ammonia.

Ammonia: The yield of 20.45 lbs. sulphate per net ton dry coal is the highest that has ever been obtained at Milwaukee for any calendar six months' period. The first three months of 1908 is better by about 1 lb.

Tar: Each year the tar yield for the first six months' period when coal is used which has been stored since the previous year, is lower than the yield for the second six months' period when fresh coal is used. The yield of 6.25 gallons per net ton dry coal for the first six months of 1905 is the highest yield ever obtained at Milwaukee for the first six months' period of any year.

Light Oil: The light oil yield of .72 gallons per net ton dry coal was low, due to the fact that the L. O. plant had recently been put into operation, and to the fact that the inefficient exhausters did

not permit passing all the lean gas through the L. O. scrubber. An unnecessary delay, for which Mr. Greim was responsible, in repairing the L. O. scrubber after an explosion also reduced this yield. In spite of these conditions, the yield was higher than for 1907, and nearly as high as for 1906.

Gas: The average for this six months' period of 3,100 ft. per net ton dry coal, is much higher than has ever been obtained for a 6 months' period by M. C. & G. Co.'s operation.

The candle power of the gas, 18.78, is higher than has ever since been obtained for a 6 months' period.

Total Value of the By-Products: Assuming in all cases the same prices per similar unit for the by-products, the total value of the by-products obtained during the first six months of 1905, per net ton dry coal, was higher than ever has been obtained in any subsequent 6 mos. period.

At other Semet-Solvay plants improvement has been made in several features of the by-product recoveries during the three years since the first half of 1905, but the Milwaukee by-products, instead of improving, have never equalled those of the first six months 1905.

SECOND SIX MONTHS 1905.

It may be asserted by M. C. & G. Co. that although S. S. Co. obtained high by-product yields during the first six months of 1905, they failed to do as well during the second six months. This is true, but the reason is that the operation was much interfered with by construction of the second 80 ovens and the operation of the first 80 by Mr. Greim was very bad. He allowed the plant in many respects to become so badly run down that frequent interruptions to the operation occurred, and his organization became much demoralized. This was partly due to his failing health, which sent him to the hospital in October. The plant had been allowed to get into such bad shape that an extraordinary amount of repair work was necessary before it could be put into shape for good operation. This occupied much of Mr. Davis's attention for the rest of 1905, and the operation had received such a handicap during July, August and September, that it required months for it to regain the lost ground.

XII.

M. C. & G. CO.'S ENGINEERING.

M. C. & G. Co. has often claimed that they have expended large amounts of money for improvements in the Milwaukee plant since taking over the operation, the sum of $600,000 having been mentioned at various times, and that this expenditure has been largely for the benefit of S. S. Co. Mr. Schlesinger's letter of June 3rd, 1907, to Mr. E. L. Pierce shows clearly that he feels that these expenditures were made very largely for S. S. Co.'s benefit.

This, however, is not the case. In the first place, M. C. & G. Co. has expended the money for the **appearance** of the plant, and for increase in coal tonnage and the reduction of their operating costs. In some cases large amounts were spent for unnecessarily expensive buildings, and for changes in plant not carefully thought out, which resulted in throwing out expensive installations shortly after they were put in run. In some cases S. S. Co. protested against the changes proposed, and in other cases, where not directly concerned, but where advice was asked, advised against them.

The expenditure for raising the ovens to 5-high would operate to the advantage of S. S. Co., provided the coal tonnage of the plant exceeded 37,333 tons per month, and provided the by-products were fully recovered. The basis of this advantage is that S. S. Co. pays on the excess tonnage operating charge of 76.7c per ton coal, but does not pay rental. If the by-products were fully recovered, the return from them per ton coal should be over $1.00, so that S. S. Co. would profit by the difference. Unfortunately for S. S. Co., the by-product recovery apparatus was increased at almost no point, to take care of the by-products from an increase of 25%, or as claimed by M. C. & G. Co., 40%, in the coal tonnage. In the case of condensing apparatus and ammonia scrubbers, the plant was actually reduced at the time the increase to 5-high was made. The design and construction of the silica oven Block No. 3 is so bad that the loss of S. S. Co.'s by-products has been much increased.

It thus results that the gain to S. S. Co. is not only quite problematical, and accompanied by the risk attendant upon an increase in coal tonnage on which it must pay operating charges, but even in some respects operates to the disadvantage of S. S. Co. Although large amounts were spent for which M. C. & G. Co. will realize no return, the increase in plant alone should give M. C. & G. Co. a handsome profit.

It is evident, therefore, that M. C. & G. Co.'s claim that this expenditure has been largely for S. S. Co.'s benefit is unfounded.

Before the change of ovens to 5-high, certain estimates were made regarding capacity of the plant for coal tonnage and regarding by-product yields to be obtained. The estimated capacity of the plant has never been realized, and the yield of gas has not even approached the estimate.

APPENDIX INDEX.

Designation of Appendix		Corresponds to Page of Letter	Description of Appendix
Letter	Number		
F	5-Mc-120	16	Coal mixture charge.
B	4-Mc-115	17	Fire boat record.
B	Chart	18	Chart showing drop in gas due to burned coal.
A	5-EH-91	23	Over-payment of operating charge.
A	5-EH-92	23	Over-payment of gas enrichment rebate.
A	5-EH-93	23	Over-payment of rental.
A	4-GCS-84	24	Gas to drive off excess water.
C	4-Mc-116	29	Oven repairs.
D	5-LML-115	34	Gas yields.
D	Chart	36	Chart of gas yields Detroit, Chicago, Milwaukee.
C	5-Mc-118	46	Gas penalties.
E	4-EH-181	56	L. O. Loss.

B9

"HISTORY OF THE MILWAUKEE SOLVAY COKE COMPANY"

1958
History (~1960), also, Chain of title (last)

OVENS

Blocks #3 and 4 Semet Solvay ovens started operation in April 1904. As originally constructed, these ovens were 16½" wide x 6'6" high and 35'0" long, taking a charge of 7.82 tons of coal.

Blocks #1 and 2 Semet Solvay ovens started operation in April 1906 but were 5 flues high instead of 4 - dimensions 15-3/4" wide x 8'1½" high x 36 ft. long, taking a charge of 9½ tons of coal.

During the period 1906 and 1907 Blocks 3 and 4 were also changed to the 5 flue type, same as Block 1 and 2. In 1909 and 1910, all ovens were relined with silica brick. All ovens relined after 1910 were so constructed to obtain a 17" average width and the longitudinal taper was increased from 1½" to 2".

Block #1 operated continuously until it was closed down on November 11, 1920 for dismantling and replacement by a 50 oven triangular Flue Koppers block which was put into operation August 24, 1921.

Block #2 was operated continuously from 1906 to July 31, 1921 when it was dismantled and replaced by present Koppers Block #2. The second Block of Koppers ovens was put into operation April 20, 1922. Both Koppers blocks have operated continuously since originally charged.

Semet Solvay Block #3 was shut down account of depression from September 2, 1921 to October 13, 1922 and has operated continuously since that time. Block #4 has operated steadily since 1906, approximately 52 years.

In 1952, 20 additional Solvay type ovens were added to the north end of our existing Semet-Solvay battery #4, making this, a 60 oven instead of a 40 oven battery.

The original collecting main on Solvay Battery #4 was replaced by a Pullman valve type main with accessory piping in 1953.

The Hot Tar drain installation installed in 1921 was dismantled and replaced by a rectangular tar & liquor decanter in 1953. This decanter was supplied with a motor operated flight conveyor for continuous tar removal.

In 1957, all flushing liquor piping on the two Koppers coke oven batteries was replaced.

COAL HANDLING

The first coal boat was unloaded November 1903 by means of steam operated Brown Hoist Dock Rigs #1 and 2. These rigs were originally of the incline boom counterweighted type.

In 1906, the coal bridge was put into service and dock rigs #1 and 3 were reconstructed with new machinery, horizontal booms and new buckets as the inclined booms did not allow the coal bridge to pass.

In 1930, #3 Dock Rig was remodeled, electrified and a larger bucket added which was counterweighted for smoother operation.

No. 1 Dock Rig was also completely modernized and electrified in 1937 with counterweighted bucket. Both these rigs are in first class condition.

No. 2 Dock Rig was built in 1907 by Greer-Thompson Co. to operate as a steam rig. In 1910, this rig was electrified, all steam equipment being replaced.

In 1907, the breakers, pulverizers and mixing equipment were installed by Heyl Patterson in wooden structures. In 1910, the wood structures were replaced by permanent constructions of brick, concrete and steel buildings.

Very little is known of the coal preparation equipment prior to 1907 except that it consisted of a counterweighted car haul system feeding to present "M" conveyor with a crusher and elevator in the present Solvay Coal bin.

The coal conveyor system has been rebuilt from time to time as follows:

"A" Conveyor - 1926
"B" " - 1926
"C"& "D" Conveyor - Destroyed by fire and completely rebuilt in 1922.
"J"1 & "J"2 Coal conveyors built in 1907 were partially rebuilt when the Koppers blocks were installed in 1921.
Conveyors "R" & "S" to the Koppers bin were built in 1921.

The coal bridge was provided with automatic clamps in 1926.

In 1941, an 8 ton Wellman-Hullett type coal bucket with digging teeth was purchased for use on the Coal Stocking and Reclaiming Bridge.

In 1945, the 3 dock rigs were equipped with steel safety storm struts, special watchman's clock and rail bumpers.

A Caterpillar Diesel Operated Tractor was acquired in 1951 for compacting coal in the Storage Pipe.

A Fifth Coal bin was added to the existing 4 coal bins over the Pulverizers together with conveyors chutes, feeders,etc. for improved blending of By-product Coals. The bin will hold 165 tons of coal.

In 1955, the original tripper on our Coal Stocking & Reclaiming Bridge was dismantled and replaced by a modern motorized tripper.

The original sleeve bearing conveyor idlers were replaced by roller bearing idlers.

In 1956, the 3 Dock Coal Unloading Rigs were equipped with Centralized Lubrication Systems, replacing the original manual system.

A crawler type Tractor equipped with a bulldozer blade and rubber treads was purchased in 1957 to replace the original machine for cleaning up the holds of lake freighters after unloading the coal cargo.

BY PRODUCTS (GAS)

(1) By Product Building

The original by-product building (1904) housed 3 small engine driven exhausters and some ammonia and light oil scrubbing equipment, hence the name By-Product Building.

In 1906, this building and equipment was destroyed by fire and rebuilt with 6 - 33 cu. ft. engine driven exhausters, Holmes Rotary Scrubbers and wash boxes. Fireproof construction was used on the new building. In 1907 a seventh engine exhauster unit was added, and in 1914, it was necessary to add a 14,000,000 cu. ft. 24 hr. engine driven booster (old #8) to pump surplus gas to the Third Ward plant.

In 1921, 2 Ingersoll-Rand 10,000,000 du. ft. gas compressors #7 and 8 were installed to take care of the additional surplus gas released by the Koppers ovens.

In 1923, a 96 cu. ft. steam driven Connersville Exhauster #6 was installed to take care of Blk. #3 and 4, but this unit now handles the additional surplus gas released by the addition of a producer gas plant in 1929. In 1930, a duplicate 96 cu. ft. unit #5 was added as a spare for city gas pumping.

6 of the 7 - 33 cu. ft. exhauster units were dismantled and scrapped in 1929 and 1930 and were replaced by Vertical Engine driven 96 cu. ft. pumps obtained from the Milwaukee Gas Light Company. These are designated as #2, 3 and 4 Exhausters. The #1 Exhauster unit is the remaining 33 cu. ft. blower which should be replaced with the 96 cu. ft. unit, still at the Milwaukee Gas Light Company West Side Pumping Station. All steam, gas and water piping in the B.P. Building have been replaced since 1921.

In 1947, an additional Ingersoll-Rand 7,800,000 cu. ft. 24 hour capacity engine driven gas compressor was installed, replacing the last of the 7 - 33 cu. ft. exhauster units.

(2) North Condenser Gas Bldg.

This was originally a corrugated iron building with 8 tubular coolers 9'0" dia. x 27'0" high. In 1910, the lean to, a brick and steel structure was added to the east side and in 1915 the original corrugated iron structure was dismantled and replaced with a permanent brick and steel structure. In 1916, the tubular coolers were changed to the wood hurdle type with accessory circulating pumps and the gas piping on the 4 coolers before the exhausters was increased from 20" to 24". The decanters and storage tanks are of the original construction except that the former have been rebuilt in the past 10 years.

In 1950, a 15,000 MCF Connersville Gas meter was installed to measure surplus coke oven gas delivered to Milwaukee Gas Light Company.

In 1953, a complete modern condensing equipment was installed for the Semet-Solvay Batteries in order to handle the additional gas production. Two hurdle type 10'6" dia. x 56 ft. high coolers were added with accessory circulating pumps, piping, etc.. A rectangular tar & liquor decanter, 10 ft. x 10 ft. x 37 ft. size, with motor driven flight conveyor for tar removal. Also installed were 2 liquor pumps directly connected to the decanter.

(3) South Condenser Gas Bldg.

Originally built in 1906, a corrugated iron building, housing 8 - 9 ft. dia. x 20 ft. high tubular coolers. In 1909, 8 additional coolers were added at the south end of the building, but of the wood hurdle type. In 1915, the corrugated iron siding was replaced by brick. In 1917, the 8 original tubular coolers were changed to the wood hurdle type and gas piping increased 20" to 24". Circulating pumps were also added at that time with additional atmospheric cooling coils. In 1927, an explosion demolished the roof and all sash at which time a Robertson APM roof was erected and new sash installe

In 1940, a 20,000 gallon bunker oil unloading and storage system was installed to permit the addition of bunker oil to pulverized coal for additional gas production.

In 1945, #6 spare exhauster and booster unit in the Exhauster Bldg. was equipped with an Askania Suction Control Regulator.

A spare turbo driven pump for emergency circulation of liquor was added in 1953. This unit has a capacity of 2,000 gallons per minute.

(4) Fuel Gas Holder

1 - 40,000 cu. ft. single lift 56" dia. holder was installed in 1910. In 1937 a new cover was welded over the top of the original one.

The sides of this holder were replaced in 1952.

BY PRODUCT(TAR)

One 55'0" dia. x 31' high 500,000 gal. tar storage tank was installed in 1909. On August 20, 1938, this tank was struck by lightning making it necessary to replace the roof and top course of sheets. All tar pumps and smaller tanks were erected about 1906. The original tar storage tank 32' dia. x 20' high, 120,000 gal. capacity, is now used as a settling tank for the ammonia recovery plant. This tank was built about 1906. A Dorr Clarifier Agitator was added to this tank in 1926, in connection with the sanitary sewer system.

The tar equipment for the Koppers blocks was erected in 1923.

In 1929, A Cottrell electrical tar precipitator was put into operation. The original P. & A. extractors were abandoned about 1908 and these were not replaced.

The 7' dia. x 23' long Tar Collector tank at the Tar Storage tank was replaced in 1956.

BY PRODUCT (AMMONIA)

The Ammonia Concentration Building was built in 1904 of wood and brick construction similar to our front garage. In 1916, this was torn down and a structural steel, brick wall and fireproof roof was erected. At the same time a 5 ton crane was added. The building was reroofed in 1925.

The lime storage lean-to was built in 1911.

The weak liquor storage tanks 22' dia. x 16' high, 42,000 gal., were built in 1904. In 1907 a fifth weak liquor tank 32' x 20', 120,000 gal. was added.

Three concentrated ammonia storage tanks 26'6" dia. x 20' high, 55,000 gal. each, were added in 1916, replacing 4 - 16,000 gal. horizontal tanks.

Three separate sets of ammonia concentrating equipment are located in the ammonia building. These were originally of cast iron, erected in 1904, 1906 and 1913, respectively. In 1925 and 1926, the 3 washers and the 3 partial coolers were changed from cast iron to aluminum.

In 1929 and 1930, the preheaters were raised 6 rings in height to permit a liquor concentration of 30%. The fixed and free stills have been rebuilt from time to time and only the tanks and pumps remain of the original construction.

In 1943, an 8" underground tile duct was installed between the Ammonia Concentration building and the 200 foot high stack of Koppers battery #2.

In 1955, one of our original (Ammonia Weak Liquor Tanks) 22 ft. dia. x 16 ft. high was dismantled and replaced with a simillar tank of 50% additional capacity.

BY PRODUCT (LIGHT OIL)

The original light oil plant was installed in what is now the Power House annex and Mechanical Wash Room. Only light oil was recovered and this plant operated until 1910 when it was shut down and the new one in the present benzol scrubbing (LBA) building and the L.O. Building was started.

There were 6 benzol hurdle type scrubbers in this building - 5 - 9'0" dia. x 27' high and one 8'0" dia. x 27'0" high. The light oil was sold to the Solvay Company and no distillation was attempted.

In 1916 the scrubbing capacity was increased by 3 additional washers, one 10' dia. x 38'6" high, the other two 12'0" dia. x 63'0" high. In 1926, two of the 9'0" x 27'0" washers were replaced by two Koppers scrubbers, hurdle type, 9'0" dia. x 90'0" high and the hurdles were removed from the three south Solvay scrubbers inside the building and converted to pure residue storage tanks for the benzol recovery, giving additional storage capacity as follows: 2 - 11,000 gal. capacity and one 7,000 gal. In 1923 the L.O. Plant was destroyed by fire and new wash oil still 8'0" dia. with accessory tanks, coolers, etc., replaced the Semet Solvay process, the plant being completely rebuilt.

The original 1910 L.O. Storage tanks were located in a concrete pit on the site now occupied by the tank house. This pit later became the foundation for the brick and steel tank house which was destroyed in 1923.

BY PRODUCT (BENZOL)

In 1915 Benzol recovery was started on a small scale using the Barrett process using 2 vertical 8'0" dia. x 8'0" high stills with a 36" bell column. At that time 2 tiers of tanks were added in the tank house for storing intermediate and pure fractions and a brick structure was erected over the tanks.

In 1917, 2 - 8,750 gal. stills with 5'0" dia. columns were added with accessory coolers, etc.

In 1920 the 2 small 36" columns were replaced by a 5'0" dia. column.

In 1923 the entire benzol plant was demolished and in April 1924, the present plant was put into operation, designed for 50% additional capacity over the former plant. This plant was equipped with ventilating systems which make a complete air change every six minutes.

A complete Ansul Fireprotection System was added in the Benzol Rectifying and Oil Storage buildings installed in 1951.

In 1953, the Connersville absorbent oil pump together with the debenzolized oil pumps were replaced by turbo driven centrifugal pumps.

The 14,500 Gallon Sulphuric Acid Storage tank was dismantled and replaced in 1957.

BY-PRODUCTS (MISCELLANEOUS)

A portable Connersville gas purging machine was bought in 1951

A complete natural gas piping system was installed to supply mainly off peak gas to our main boiler house. In 1952, this gas was utilized for the production of steam.

1,000 ft. of 24" and 20" gas line installed for handling additional surplus gas released by the Butane Producer Gas Underfiring System in 1947.

COKE HANDLING

The original quenching cars were small units with electric locomotives, the gates being operated by hand. In 1909, 9 larger Atlas quenching cars were put into operation, these also having manually operated unloading gates. No locomotive was used, the motors and controllers being carried by the quenching cars.

These were replaced with 3 electric locomotives and quenching cars with air operated gates in 1931, one used as a spare, i.e., 2 cars did the work of 5.

The coke handling was housed in a long coke shed about 400' long located west of blocks 3 and 4. This shed housed a revolving screen for sizing furnace coke, the screen being replaced in 1923 by a Robbins 8 roll grizzly. No coke wharf was provided, the coke being discharged directly into a chute leading to a 2 roll crusher, thence to the screen after which a loading chute discharged the coke into Railroad cars.

The foundry coke was sized over a stationary bar grizzly, replaced in 1927 by a Robbins grizzly, thence onto a shuttle conveyor which loaded either open top flat bottom gondolas or box cars, the latter being pended on a tilting box car loader.

The undersize was crushed and delivered to the domestic building on the present incline conveyor. The screening system consisted of 2 large and 2 small revolving screens, the former separating egg, range and nut, the latter the pea and breeze. There was no boom loader, the open top equipment being loaded with a chute, the box cars being loaded with present 16" car loader. The rescreen consisted of small stationary screen plates discharging the fines onto the present 16" breeze conveyor and the present belt elevator. This equipment was put in about 1906 except as noted.

In 1926 the Domestic Screening and Loading was rebuilt, all rescreening being done over vibrating screens. 1,000# weigh hoppers for loading trucks were installed, a boom loader was installed for loading open top R.R. equipment, the Manierre box car loader, breeze conveyor and breeze elevator being the only rescreening equipment retained. In the screening room, 2 rotary grizzly screens, 2 shaker screens and 4 vibrating screens replaced the old revolving screens, all of the original equipment being discarded, after the crushers.

In 1928 loading of furnace coke was abandoned and this equipment was torn out in 1931.

In 1930 the present foundry coke handling installation was installed consisting of a 2 car wharf, a wharf conveyor, incline conveyor, 12 roll grizzly screen, 36" picking table, boom loader, Ottumwa box car loader with 2 steel and corrugated iron structures housing the screen and box car loader respectively.

In 1931 the present crushing system was installed with accessory conveyors, and one car domestic coke wharf which in 1938 was increased to accomodate 2 cars easily, 3 in an emergency.

In 1941, an additional foundry screening building housing, screens, elevators, conveyors, chutes, etc., was installed south of the foundry screening station erected in 1930. The combination of the two installations permitted sizing and loading 2 - 3 sizes of foundry coke.

In 1950, additional coke screening equipment was installed to size Furnace Coke.

A buckwheat coke screening installation was added in the Domestic Coke building in 1950.

A Foundry Coke Car loading station for medium size coke was added in 1952, complete with beam loader and accessory conveyors and structures.

In 1952, one of the 3 quenching cars purchased in 1931 was dismantled and replaced with a modern car of later design. In 1956, the second of the 3 quenching cars obtained in 1931 was retired and replaced by a car similiar to the one acquired in 1952.

The original 2 - 10 ton wagon scales were replaced by two 30 ton truck scales, each with a 40 ft. long platform in 1953.

In 1954 a coke inspectors station was installed with accessory conveyor, spiral chute and structural work to improve the handling and inspection of our intermediate size foundry coke.

The 12,000 gallons Koppers Quenching Tank was replaced by a similar tank in 1953.

A Michigan #125 Front end loader was purchased for stocking & reclaiming foundry coke, also for general yard use in 1956.

The Solvay Batteries Coke quenching station was rebuilt in 1956.

The Hummer vibrating rescreen for Chestnut Coke was discarded and replaced by a larger Robins Gyrex Screen in 1956.

In 1957, both Robins eliptex screens in the Domestic Coke Screening building were equipped with electrically heated screens and accessories for increasing buckwheat coke production.

A portable Barber Green Coke Stacker equipped with a conveyor 60 ft. long was acquired in 1957 for stocking Foundry Coke in our storage yard.

STEAM PRODUCTION

The original steam supply was obtained from the 4 - 400 H.P. waste heat boilers of Solvay Blocks 3 and 4, the 4 - 400 H.P. waste heat boilers of Solvay Blocks 1 and 2, also 3 - 400 H.P. return tubular auxiliary boilers located in the space now occupied by the present boiler house.

All of these units have been dismantled with the exception of the 4-Block 3 and 4 Solvay waste heat boilers. The present boiler house was constructed in 2 steps, the North portion, 3 bays, being erected in 1918, the South 4 bays being completed in 1921. The boiler house comprises 2 - 400 H.P. Badenhausen, 2 - 400 H.P. Kidwell and 4 - 600 H.P. Kidwell boilers, a total of 4,000 Boiler Horse Power. All boilers are of the Ring Circuit Water Tube type.

Six Waste Heat boilers installed by the Koppers Company in 1929 after the Producer Gas Sets complete the steam generating units.

In 1948, a Robins Car Shaker was added to the Boiler House Fuel Unloading system.

In 1950, an Internal Phosphate treatment was installed in our Main Boiler House as an addition to our regular water softening plant.

No. 8, 400 H.P. Badenhausen Boiler was remodeled in 1953 to permit the use of coal as well as coke breeze for underfiring. The ignition arch and baffling were altered and sprays were installed in the fuel bin for use when burning coal.

In 1955, No. 3, 600 H.P. Kidwell boiler was converted from Coke breeze to Coal underfiring. No. 6, 400 H.P. Kidwell boiler was also similarly converted in the same year.

In 1957, the original draft controls on 4 - 600 H.P. Kidwell boilers were replaced by an installation of improved design.

ELECTRIC LIGHT AND POWER

The Main Power House structure was built in 1903 of wood and brick similar to our front garage. In 1951 that portion of the building above the ground was replaced with steel columns and trusses, brick walls, steel sash and fireproof roof. The original foundation which was of concrete was not changed. In 1926, the asbestos roof was replaced.

The Power House Annex was built in 1903 of concrete brick, and structural steel construction and was originally used for recovery of Light Oil. No. 6 - 600 K.W. Turbo Generator, a De Laval Crocker Wheeler Unit, was installed in this building in 1914, a 1000 K.W. Allis Chalmers Motor Generator Unit #7 was installed in 1928 and two motor driven air compressors were installed in 1938, replacing 2 steam driven air compressors dating back to 1904.

The Generating Units in the Main Power House were installed as follows: Three 200 K.W. Ball & Wood General Electric Engine driven units, #1, 2 and 3, were erected in 1904. In 1906, a 300 K.W. Engine Generator Unit #4 was added. In 1909, #5 Rateau-Smoot 600 K.W. Turbo Generator unit was installed.

In 1945, the main switchboard was remodeled in the Power House and extended west as recommended by the United Light and Power Service Department and the Wisconsin Electric Power Co.

In 1945, a De Laval Centrifugal oil purifier was installed in the Power House for centrifuging lubricating oil.

WATER SUPPLY

The original plant water supply consisted of an artesian well system which was found inadequate and abandoned after a short period of operation. A pump house was erected at the dock at the S.E. corner of the property and began operation with 3 centrifugal pumps, 1200 gal. min., each belt connected to 50 H.P. motors. A fourth centrifugal pump was added in 1912, this one direct connected to the motor and of 1400 G.P.M. capacity. In 1909, a 1500 G.P.M. pump was installed to furnish condenser water for #5 Turbo Generator Condenser in the Power House.

This system could not supply the plant requirements so in 1917, 2 - 10,000 G.P.M. turbo driven steam units with 2 - 5,000 G.P.M. condenser water pumps were located in the Water Purification Bldg. basement and the dock pump house was abandoned. The structure itself was similar to the front garage.

The apparatus for the treatment of boiler feed water is practically the same as when originally constructed in 1906, except that Sodium Aluminate and Nalco have been added to the chemicals and the lime and soda amounts reduced.

A concrete tunnel 7'6" wide and 6' high containing 2 - 24" suction lines from the dock intake to the mill pumps, was constructed in 1916. In 1926 Chain Belt Co. electrically operated screens were installed at the intake, replacing stationary screens. A structural steel building with asbestos transite siding and roofing was erected to house the screens.

The two present turbine driven boiler feed pumps are located in this building with 2 feed water heaters, these being installed in 1916, replacing the 3 original reciprocating pumps installed in 1904 and 1906.

In 1951, one of the 2 - 10,000 G.P.M. turbo driven steam mill water pumps was replaced with a centrifugal pump of similar design. In 1953 the other pump was similarly replaced.

OFFICE & UTILITY BUILDINGS

The present front garage was the original main office and was built in 1903.

The Engineering and Laboratory office was put into use in 1911. In 1913 the Sales and Accounting office was finished.

The remainder of the utility buildings were completed as follows:

1. Dock Foreman's office.
   Built in two steps. Front portion built in 1908 - 18' x 24' x 10'8" high.
   In 1911 - 21 additional feet were added for locker and wash room facilities.

2. Quenching car round house	1921
3. Coke Handling Wash Room	1910
4. Gas Testing Station	1911
5. Fire Pump House	1908
6. Machine Shop	1907
7. Blacksmith Shop	1908
8. Carpenter & Pipe Shop	1909
9. Oil and Paint House	1908
10. Repair Garage 24' x 42' in	1916
Addition 24' x 37' in	1919
11. Employes garage - West Yard	1916
- East Yard	1920
12. Switchman's Office	1917
13. Watchman's House	1917
14. Shift Foreman's Office	1909
15. Hose House #1	1909
" " #2	1929
16. Yard Fence	1917

In 1945, a J-233-H Shop Mule Tractor equipped with a cable winch was added to the Mechanical Department equipment.

In 1941, a Washroom was constructed on the ground floor of the Solvay Batteries Coal Bin Building and fully equipped with shower room, toilet, steel lockers and Bradley wash fountain.

In 1941, air conditioners and flourescent lighting were installed on the second floor of the Main Office in the Accounting and Clerical offices. Flourescent lighting was also installed in the laboratory of the Engineering and Laboratory Bldg. In 1945, all offices on the first floor of the Main office were provided with flourescent lighting.

In 1942, the South end of the plant at the P.M. Carferry slip was enclosed with a galvanized woven link iron wire fence 8'0" high and 315 ft. long. A wood retaining wall was included affording additional protection against wash-outs.

In 1942, the Reflectolux lights were installed along the property boundary and plant fence for protection against sabotage.

In 1948, a Storage building for Oven brick shapes and spare parts was installed west of the Benzol Scrubber building.

In 1952, a storage building of structural steel framing, with corrugated iron roof & siding, 54 ft. wide x 96 ft. long x 16 ft. high was erected on our East Yard property for housing large repair parts.

The Lime Storage building was dismantled and a Riggers Tool building erected in its place in 1954.

In 1956, a pressure test oven for testing properties of by-product coals was installed in our Coke Sampling Laboratory.

TRANSPORTATION EQUIPMENT

(1) Locomotive Cranes

Original locomotive crane, 10 ton, used. Acquired from Industrial Brownhoist in 1903. This was sold to the Newport Company in 1917. Present #1 crane, 15 ton Link Belt Company, purchased in 1917. #2 crane purchased from the Dodge Coal Storage Company now the Link Belt Company, in 1908. #3, 15 ton crane, purchased from Link Belt Company in 1920. #4, 15 ton Industrial Brownhoist crane, purchased second hand from Milwaukee Dry Dock Company. Crane built about 1917, acquired by us in 1929.

In 1952, a 20 ton Diesel Powered Locomotive Crane mounted on R.R. type Trucks was purchased for stacking & reclaiming coal and general yard work.

(2) Locomotives

The original locomotives, 2 - 12" x 16" Class F3 Manhattan, were purchased by Semet Solvay in 1903. In 1910 one of these was sold to a construction company and in 1912 the other was sold to the Northwestern Iron Company of Mayville, Wisconsin. In 1910 and 18" x 24" Baldwin 6 wheel steam switching locomotive was acquired. This was used until 1938 when it was replaced by a Diesel unit. In 1917 a duplicate Baldwin steam engine #3, duplicate of the one purchased in 1910, was acquired and this is at present used as a spare for the two Diesel units. For switching in the Coke Handling, a Baldwin 4 wheel saddle tank locomotive was purchased in 1912, replacing the Manhattan sent to Mayville. This was scrapped in 1938.

On December 31, 1936, our first Ingersoll-Rand G.E. 60 ton Diesel Electric switching locomotive was delivered, our #104, and on October 26, 1937, the second Diesel Electric Unit, our #105, a duplicate of #104, was delivered. These two units plus spare steam locomotive #3, comprise our present switching locomotives.

One 65 ton Diesel Electric Switching locomotive was acquired, replacing the steam engine #3.

(3) Railroad Cars

In 1904 - 6 steel hopper bottom 50 ton Gondola Railroad cars were purchased by the Semet-Solvay Company. These are still in use. In 1929 - 6 second hand cars of the same description were added to transfer producer fuel from the Domestic Screening Plant to the Producers.

In addition, two wood flat bottom and a wood flat car are available for rubbish disposal, construction or maintenance work and spillage recovery. Acquired about 1917. All of these cars are in use.

In 1942, 6 all steel, 50 ton, used hopper bottom gondola R.R. cars were purchased. These were equipped by us with wood racks, increasing the capacity of the cars to maximum that our plant clearances would permit.

In 1947, 10 - 8,000 gallon capacity R.R. tank cars were added for use in interstate commerce.

In 1951, 2 Railroad Flat Cars were purchased for general maintenance purposes.

Two 8,000 gallon capacity R.R. tank cars were acquired in 1956, making a total of 12 tank cars suitable for interstate commerce.

PRODUCER GAS PLANT

In 1943, a Cottrell electrical precipitator was added to clean producer gas used in underfiring the Solvay Batteries.

In 1944, a Mechanical Ventilating System was installed over the Gas Producer charging floor to remove producer gas while charging the feed hoppers.

PETROLEUM UNDERFIRING

In 1942, a bulk natural gasoline unloading and storage system was installed consisting of 6 - 11'0" dia. vertical storage tanks in an approved spillage pit. The tanks provide a working storage of 90,000 gallons. A concrete foundation supported on wooden piling supports the tanks. A Model #15 Foamite Underwriter's approved fire protection system is provided.

In 1942, a Natural Gasoline Producer Gas Underfiring plant was installed in the North Scrubber building to provide an 800 B.t.u. gas mixture for underfiring the Solvay Batteries #3 and 4, the principal items consisting of an MYMD-28 Hills-McCanne Dual Metering Pump, a 36" dia. x 72 ft. high fractionating column, a Cutler-Hammer recording calorimeter, bottoms oil pump, cooler and storage tank, 2-5 ft. dia. tubular heaters, 2 oven propeller fans, electrical signal system charging pump and tank and gas mixer.

In 1943, a Butane-Natural Gasoline blending system was installed to Maintain the required vapor pressure on the Butane-Natural Gasoline mixture fed to the fractionating column.

In 1943, a Cottrell Hot Cathode Rectifier was installed at the Koppers Batteries Ram Changing Station to clean the producer gas used for underfiring Solvay Batteries #3 and 4.

In 1946, the bulk natural gasoline unloading and storage system was dismantled and replaced with four 25,000 gallon Propane-Butane Tanks.

In 1950, the Natural Gasoline Producer Gas underfiring plant was dismantled and replaced by a Vaporizer installation.

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MILWAUKEE COKE & GAS CO./MILWAUKEE SOLVAY COMPANY
BROWN'S DIRECTORY SUMMARY
NOTES

Production Summary
1920 - 1950

1 Gas sold to Milwaukee Gas Light Company
2 Milwaukee Coke & Gas became Milwaukee Solvay Coke Co. in 1942
3 Milwaukee Coke & Gas Company was controlled by The Newport Co. 1926-1927
4 Milwaukee Coke & Gas Company was controlled by Koppers Gas & Coke Co. 1928
5 Milwaukee Coke & Gas Company was controlled by American Light & Traction Co. 1929-1947
6 Milwaukee Gas Light controlled Milwaukee Solvay as of 1948
7 Use of Surplus Gas from 1920-1927: Heating Retorts
8 Use of Surplus Gas from 1928-1930: Domestic Consumers
9 Use of Surplus Gas after 1930: Not Stated
10 Use of Coke up to 1930: Foundry furnace and domestic
11 Use of Coke after 1930: Not stated
12 Information is not available for 1925, 1931, and 1936-1939
13 Ammonia Sulphate was a large by-product in the 1920's
14 Stopped selling by-products in 1943
15 1944 & 1945 statistics are identical
16 1947 & 1948 statistics are identical
17 Gas sold for city use increased over time; subsequently, gas sold for heating oven decreased over time

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MILWAUKEE COKE & GAS CO./MILWAUKEE SOLVAY COKE COMPANY
BROWN'S DIRECTORY SUMMARY

DESCRIPTION	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Coal Charged per Oven (net tons)										
Semet-Solvay	10.00	10.00	10.00	10.00	10.00	----------	10.00	10.00	10.25	10.19
Koppers	----------	----------	11.65	11.65	11.65	----------	11.65	11.65	10.84	10.74
Coke Yield (includes breeze)	----------	----------	----------	77.0%	77.0%	----------	77.0%	77.0%	----------	----------
Kinds of Coal										
High Volatile	----------	----------	----------	74.6%	74.4%	----------	75.0%	77.0%	75.0%	65.8%
Low Volatile	----------	----------	----------	25.4%	25.7%	----------	25.0%	23.0%	25.0%	34.2%
Anthracite	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
Calorific Value (BTU)										
Heating Gas	620	600	525	525	520	----------	538	538	533	523
Semet Solvay										
Koppers										
Surplus Gas	610	600	----------	----------	----------	----------	528	528	533	527
Gas Sold for City Use	32.0%	33.0%	45.0%	53.0%	52.0%	----------	55.0%	57.0%	57.0%	54.0%
Gas Sold for Heating Oven	71.0%	67.0%	55.0%	47.0%	48.0%	----------	45.0%	43.0%	43.0%	46.0%
By-Products										
Gas Made ('000 cu. ft.)	9,092,000	8,000,000	5,000,000	6,714,493	9,348,873	----------	8,341,342	8,999,537	9,350,014	7,383,164
Oven Gas Made ('000 cu. ft.)	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
Producer Gas Made ('000 cu. ft.)	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
Sold ('000 cu. ft.)	----------	----------	----------	----------	----------	----------	4,664,243	5,168,544	5,297,558	3,963,221
Used by Company ('000 cu. ft.)	----------	----------	----------	----------	----------	----------	3,677,099	3,810,993	4,052,456	3,419,943
Tar Made (gals)	6,568,000	6,056,000	3,707,143	5,370,001	7,339,862	----------	6,766,213	7,309,830	7,368,584	5,996,265
Tar Sold (gals)	----------	----------	----------	----------	----------	----------	6,698,411	7,184,830	7,469,614	5,447,891
Ammonia Sulphate Made (lbs.)	19,255,000	16,952,000	10,090,778	13,369,140	19,881,469	----------	18,536,525	20,314,811	20,651,523	----------
Ammonia Sulphate Sold (lbs)	----------	----------	----------	----------	----------	----------	----------	----------	20,866,019	----------
Naphthaene Made (gals)	1,260,000	1,083,000	----------	----------	----------	----------	----------	----------	----------	----------
Solvent Naphtha Made (gals)	----------	----------	----------	315	----------	----------	24,249	54,792	75,528	55,632
Solvent Naphtha Sold (gals)	----------	----------	----------	----------	----------	----------	28,622	44,358	75,421	58,258
Residue (gals)	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
Residue Sold (gals)	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
Residue Used by Company (gals)	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
Pyridine Made (lbs.)	----------	----------	----------	----------	----------	----------	6,307	----------	----------	----------
Pyridine Sold (lbs.)	----------	----------	----------	----------	----------	----------	6,788	----------	----------	----------
Ammoniacal Liquor (lbs)	----------	----------	----------	----------	----------	----------	4,777,970	5,235,776	----------	3,996,939
Ammoniacal Liquor Sold (lbs)	----------	----------	----------	----------	----------	----------	4,569,754	5,373,181	----------	4,031,557
Residue (lbs)	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
Residue Sold (lbs)	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
Coke Made Dom (short tons)	710,800	615,200	337,239	187,353	264,896	----------	214,632	250,314	320,439	341,163
Coke Sold Dom (short tons)	----------	----------	----------	----------	----------	----------	257,143	251,514	280,409	338,652
Coke Used by Company (short tons)	----------	----------	----------	----------	----------	----------	26	24	----------	----------
Light Oil Produced (gals.)	----------	2,240,000	935,416	1,908,589	1,724,565	----------	----------	----------	----------	----------
Foundry (short tons)	----------	----------	----------	101,933	122,235	----------	138,217	139,453	139,956	149,861
Sold (short tons)	----------	----------	----------	----------	----------	----------	137,926	139,581	140,020	149,756
Blast Furnace (short tons)	----------	----------	----------	153,282	245,627	----------	199,780	215,705	153,512	5,304
Blast Furnace Sold (short tons)	----------	----------	----------	----------	----------	----------	199,365	216,081	153,556	149,756
Benzol Made (gals)	----------	----------	----------	----------	----------	----------	1,362,393	1,527,318	1,600,308	1,037,556
Benzol Sold (gals)	----------	----------	----------	----------	----------	----------	1,383,481	1,489,174	1,612,055	1,027,654
Toluol Made (gals)	2,514,000	----------	----------	----------	----------	----------	404,766	419,115	406,986	291,292
Toluol Sold (gals)	----------	----------	----------	----------	----------	----------	407,754	414,866	408,260	295,112
Xylol Made (gals)	----------	----------	----------	----------	----------	----------	118,375	67,053	48,992	46,391
Xylol Sold (gals)	----------	----------	----------	----------	----------	----------	116,690	70,810	48,992	46,391

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MILWAUKEE COKE & GAS CO./MILWAUKEE SOLVAY COKE COMPANY
BROWN'S DIRECTORY SUMMARY

DESCRIPTION	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939
Coal Charged per Oven (net tons)										
Semet-Solvay	10.03	------	9.87	9.51	9.50	9.70	------	------	------	------
Koppers	10.79	------	10.31	9.95	10.24	10.30	------	------	------	------
Coke Yield (includes breeze)	------	------	80.7%	80.6%	80.6%	80.2%	------	------	------	------
Kinds of Coal										
High Volatile	65.0%	------	70.0%	71.0%	70.3%	68.1%	------	------	------	------
Low Volatile	35.0%	------	30.0%	28.9%	29.7%	31.9%	------	------	------	------
Anthracite	------	------	------	------	------	------	------	------	------	------
Calorific Value (BTU)										
Heating Gas	512	------	547	526	531	535	------	------	------	------
Semet Solvay										
Koppers										
Surplus Gas	528	------	542	528	530	534	------	------	------	------
Gas Sold for City Use	67.0%	------	65.0%	66.5%	66.2%	65.9%	------	------	------	------
Gas Sold for Heating Oven	33.0%	------	35.0%	33.5%	33.8%	34.1%	------	------	------	------
By-Products										
Gas Made ('000 cu. ft.)	8,357,904	------	------	------	------	------	------	------	------	------
Oven Gas Made ('000 cu. ft.)	------	------	6,491,805	6,329,284	7,760,758	7,205,083	------	------	------	------
Producer Gas Made ('000 cu. ft.)	------	------	1,712,139	1,688,282	2,080,519	------	------	------	------	------
Sold ('000 cu. ft.)	5,598,315	------	5,345,347	5,465,220	6,515,543	5,991,381	------	------	------	------
Used by Company ('000 cu. ft.)	2,759,588	------	2,858,597	2,749,346	3,325,734	1,213,703	------	------	------	------
Tar Made (gals)	5,688,362	------	4,933,132	4,632,898	5,521,000	5,055,909	------	------	------	------
Tar Sold (gals)	5,712,062	------	4,984,598	4,560,288	5,497,710	5,265,481	------	------	------	------
Ammonia Sulphate Made (lbs.)	------	------	------	------	------	------	------	------	------	------
Ammonia Sulphate Sold (lbs)	------	------	------	------	------	------	------	------	------	------
Naphthaene Made (gals)	------	------	------	------	------	------	------	------	------	------
Solvent Naphtha Made (gals)	54,259	------	51,065	------	------	------	------	------	------	------
Solvent Naphtha Sold (gals)	47,794	------	59,925	------	------	------	------	------	------	------
Residue (gals)	------	------	11,436	------	------	------	------	------	------	------
Residua Sold (gals)	------	------	9,175	------	------	------	------	------	------	------
Residue Used by Company (gals)	------	------	2,168	------	------	------	------	------	------	------
Pyridine Made (lbs.)	------	------	------	------	------	------	------	------	------	------
Pyridine Sold (lbs.)	------	------	------	------	------	------	------	------	------	------
Ammoniacal Liquor (lbs)	4,204,475	------	3,547,602	3,300,032	3,830,149	3,727,843	------	------	------	------
Ammoniacal Liquor Sold (lbs)	4,109,184	------	3,526,914	3,190,112	3,978,850	3,790,773	------	------	------	------
Residue (lbs.)	------	------	120,488	------	------	------	------	------	------	------
Residue Sold (lbs.)	------	------	109,564	------	------	------	------	------	------	------
Coke Made Dom (short tons)	429,177	------	386,088	374,930	461,824	419,707	------	------	------	------
Coke Sold Dom (short tons)	408,934	------	338,202	343,747	378,870	354,632	------	------	------	------
Coke Used by Company (short tons)	------	------	51,052	53,291	53,548	50,628	------	------	------	------
Light Oil Produced (gals.)	------	------	------	------	------	------	------	------	------	------
Foundry (short tons)	165,795	------	68,739	39,988	52,524	64,874	------	------	------	------
Sold (short tons)	165,764	------	68,284	40,177	52,933	64,473	------	------	------	------
Blast Furnace (short tons)	------	------	------	------	------	------	------	------	------	------
Blast Furnace Sold (short tons)	------	------	------	------	------	------	------	------	------	------
Benzol Made (gals)	1,274,619	------	792,793	------	------	------	------	------	------	------
Benzol Sold (gals)	1,299,906	------	794,457	------	------	------	------	------	------	------
Toluol Made (gals)	303,600	------	295,146	------	------	------	------	------	------	------
Toluol Sold (gals)	299,973	------	306,202	------	------	------	------	------	------	------
Xylol Made (gals)	31,683	------	42,575	------	------	------	------	------	------	------
Xylol Sold (gals)	31,683	------	42,575	------	------	------	------	------	------	------

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MILWAUKEE COKE & GAS CO./MILWAUKEE SOLVAY COKE COMPANY
BROWN'S DIRECTORY SUMMARY

DESCRIPTION	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950
Coal Charged per Oven (net tons)											
Semet-Solvay	9.54	9.58	9.79	9.79	9.67	9.67	9.65	9.67	9.67	9.66	9.56
Koppers	10.49	10.60	10.91	11.00	10.96	10.96	10.97	10.92	10.92	10.92	10.62
Coke Yield (includes breeze)	81.4%	81.9%	81.5%	81.7%	81.8%	81.8%	82.0%	82.7%	82.7%	82.3%	82.4%
Kinds of Coal											
High Volatile	66.0%	66.6%	66.9%	67.7%	66.0%	66.0%	66.3%	67.4%	67.4%	73.9%	71.8%
Low Volatile	34.0%	33.4%	33.1%	32.3%	34.0%	34.0%	33.1%	31.8%	31.8%	26.1%	28.2%
Anthracite	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.8%	0.8%	0.0%	0.0%
Calorific Value (BTU)											
Heating Gas	530	530	529	458							
Semet Solvay					611	611	624	700	700	820	794
Koppers					127	127	126	129	129	132	132
Surplus Gas	530	530	529	530	525	525	523	523	523	523	519
Gas Sold for City Use	64.8%	65.6%	64.3%	81.0%	82.8%	82.8%	90.3%	97.2%	97.2%	99.7%	96.5%
Gas Sold for Heating Oven	35.2%	34.4%	35.7%	19.0%	17.2%	17.2%	9.7%	2.8%	2.8%	0.3%	3.5%
By-Products											
Gas Made ('000 cu. ft.)											
Oven Gas Made ('000 cu. ft.)	7,247,797	8,110,001	8,837,763	8,672,708	8,666,319	8,666,319	8,419,990	8,240,812	8,240,812	8,510,094	7,442,788
Producer Gas Made ('000 cu. ft.)	2,195,368	2,405,749	2,416,754	--------	--------	--------	--------	--------	--------	--------	--------
Sold ('000 cu. ft.)	6,122,896	6,894,567	7,239,406	7,030,328	7,172,488	7,172,488	7,605,675	8,009,196	8,009,196	8,488,400	7,181,477
Used by Company ('000 cu. ft.)	3,320,269	3,621,186	4,015,111	1,642,380	1,493,831	1,493,831	814,315	231,616	231,616	21,694	261,311
Tar Made (gals)	4,813,546	5,497,064	5,914,559	5,860,780	5,613,600	5,613,600	5,317,798	5,308,728	5,308,728	5,555,714	4,851,833
Tar Sold (gals)	4,864,236	5,414,459	5,966,934	--------	--------	--------	--------	--------	--------	--------	--------
Ammonia Sulphate Made (lbs)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Ammonia Sulphate Sold (lbs)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Naphthaene Made (gals)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Solvent Naphtha Made (gals)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Solvent Naphtha Sold (gals)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Residue (gals)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Residue Sold (gals)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Residue Used by Company (gals)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Pyridine Made (lbs)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Pyridine Sold (lbs)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Ammoniacal Liquor (lbs)	2,855,254	3,318,055	4,269,581	4,257,681	4,168,552	4,168,552	4,082,781	3,913,245	3,913,245	4,074,141	3,609,436
Ammoniacal Liquor Sold (lbs)	2,824,007	3,174,013	4,418,186	--------	--------	--------	--------	--------	--------	--------	--------
Residue (lbs)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Residue Sold (lbs)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Coke Made Dom (short tons)	391,300	437,434	458,788	479,405	460,505	460,505	454,642	438,839	438,839	251,478	289,470
Coke Sold Dom (short tons)	354,422	416,105	398,357	--------	--------	--------	--------	--------	--------	--------	--------
Coke Used by Company (short tons)	50,407	47,837	55,483	--------	--------	--------	--------	--------	--------	--------	--------
Light Oil Produced (gals)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Foundry (short tons)	83,351	90,235	133,768	117,243	138,326	138,326	122,348	141,159	141,159	148,636	132,850
Sold (short tons)	83,380	90,119	134,030	--------	--------	--------	--------	--------	--------	--------	--------
Blast Furnace (short tons)	--------	--------	--------	--------	--------	--------	--------	--------	--------	200,616	93,053
Blast Furnace Sold (short tons)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Benzol Made (gals)	--------	--------	--------	--------	--------	--------	1,268,395	1,210,208	1,210,208	1,252,919	1,070,994
Benzol Sold (gals)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Toluol Made (gals)	--------	--------	--------	--------	--------	--------	227,292	216,557	216,557	223,564	224,460
Toluol Sold (gals)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Xylol Made (gals)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Xylol Sold (gals)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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1959 Report

REPORT ON THE OPERATIONS OF MILWAUKEE SOLVAY COKE COMPANY

June 1, 1959

INTRODUCTION

The Milwaukee Solvay Coke Company (hereinafter referred to as the Coke Company), a subsidiary of the American Natural Gas Company system and thereby an affiliate of the Milwaukee Gas Light Company (hereinafter referred to as the Gas Company), owns a merchant coke plant located on deep water within the City of Milwaukee, Wisconsin, for the production of coke, coke oven gas and coal chemicals. Coke oven gas is sold to the Gas Company and, prior to the advent of natural gas in 1949, was a principal source of gas supply for the Gas Company. The Coke Company has been in operation for over 50 years and the management has had to alter its operations and policies to meet a wide variety of varying conditions over the years.

With the advent of natural gas to Milwaukee, supplied by Michigan Wisconsin Pipe Line Company (hereinafter referred to as Michigan Wisconsin, also a subsidiary of the American Natural Gas Company system), the Gas Company in its desire to avoid the distribution of mixed coke oven and natural gas worked out a ten-year arrangement to sell all of the coke oven gas produced by the Coke Company to the Sewerage Commission of the City of Milwaukee, (hereinafter referred to as the Sewerage Commission). A companion contract was entered into between the Coke

Company and the Gas Company (hereinafter referred to as the Coke Oven Gas Contract) for the sale of the coke oven gas to the Gas Company.

Various difficulties have arisen in operating under the Coke Oven Gas Contract and the contract with the Sewerage Commission, and recently the Gas Company has negotiated a more favorable agreement with the Sewerage Commission which will become effective and terminate the old contract as of May 1, 1959, subject to the approval of the Public Service Commission of Wisconsin. The Coke Oven Gas Contract will terminate on September 1, 1960, pursuant to notice given as provided in the contract.

A study has been made of the operations of the Coke Company and of the effect of such operations on the Gas Company to determine (a) if the Coke Company is being operated most effectively, and (b) the most desirable arrangements for the future between the Coke Company and the Gas Company, both until the termination of the Coke Oven Gas Contract in 1960, and thereafter. This report is divided into two sections, dealing with these matters as follows:

<u>Section 1:</u> The Operations of The Milwaukee Solvay Coke Company.

<u>Section 2:</u> The Future Sale of Coke Oven Gas Between The Coke Company and The Gas Company.

Section 1 deals with the following principal subjects:

1. The Coke Company Plant.
2. Coke Oven Gas Production and Sale
   (a) The Coke Oven Gas Contract
   (b) Coke Oven Gas Yield
   (c) Economics of Standby Operation
3. Other Plant Operations
   (a) Operating Practices
   (b) By-Product Yields
   (c) Firing Alternate Fuels and Power Generation
4. Maintenance and Plant Condition

Conclusions and recommendations are summarized in the letter of transmittal for this report.

THE COKE COMPANY PLANT

The Coke Company plant is located at 311 East Greenfield Avenue on 41.8 acres of land fronting on deep water of the Kinnickinnic River, providing access to Great Lakes and ocean shipping. The plant is served by the Chicago, Milwaukee, St. Paul and Pacific Railway; the Milwaukee, Chicago and Northwestern Railway; and the Chesapeake and Ohio Railway car ferry. A layout of the plant is shown in the attached Plot Plan.

The coking facilities consist of 200 ovens in four batteries. Two of the batteries are of the Solvay type with 40 ovens in one battery and 60 in the other. The other two batteries are of the Koppers type with 50 ovens each. The Koppers ovens are 17-inch ovens with some 30 feet long while the Solvay ovens are 17-inch ovens some 36 feet long, each with a nominal coal charge capacity of eleven tons at a bulk density of 50 pounds per cubic foot. Actual coal charge is about ten tons per oven or 2,000 tons for the plant of 200 ovens. The nominal capacity of the plant is about 2,000 tons per day of coal charge to produce 1600 tons per day of furnace, foundry and other cokes. When operating on foundry coke the plant capacity is 1600 tons per day of coal charge.

The Koppers ovens are equipped with heat regenerators, while the Solvay ovens use recuperative heat recovery in by-product steam generators. The ovens have compound firing and, although coke oven gas is normally fired, the Koppers ovens can

be fired with producer gas while the Solvay ovens can be fired with petroleum-enriched producer gas. There is a producer gas plant with a capacity of 38,000 therms per day and a liquified petroleum gas plant with a capacity of 14,400 therms per day, making a total gas generating capacity of 52,400 therms daily.

The plant is equipped with screens and crushers to provide the sizes desired for foundry and furnace use and the smaller egg, stove, nut, range, pea and breeze.

The gas recovery system consists of facilities to remove and recover crude tar including naphthalene, an ammoniacal water solution which is concentrated to 26% ammonia and light oils which are fractionated into benzol, toluol and mixed xylols. Neither pyridine nor sulphur are recovered. Waste liquor is disposed of to the Sewerage Commission and sulphur is left in the coke oven gas.

The boiler plant consists of eight boilers with a total capacity of 4,000 boiler horsepower, two of which are converted

also 2 are convertible to gas [illegible] firing only.

for the firing of gas as well as solid fuels, The power plant consists of three ~~four~~ steam engine driven generators, two steam turbine driven generators and a motor generator set with a combined capacity of 2,800 3,100 kilowatts of direct current.

The plant is complete with other appurtenant facilities, such as gas holders, gas compressors to transfer the coke oven gas and a water system from the river to provide cooling water and fire protection. As noted on the Plot Plan, the plant site is provided with ample dockage, railway spurs and a 480 foot coal stacking and reclaiming bridge.

The plant, out of necessity due to its age, is equipped with machine shop, pipe shop and other services required to keep the equipment in operation. A railroad system is employed throughout the plant to handle coke movement except for storage and reclaiming of coke which is done by truck.

Coal is received at the plant from April 1st to December 15th and is stacked in individual piles and impacted to protect against spontaneous combustion. Daily needs of coal for processing are transferred from the stock piles by conveyor belt and are proportioned as required by the mix being coked. The coal is weighed, mixed and crushed and then conveyed to the coke oven bins from whence it is charged to the oven chambers by overhead cars.

At present foundry coke is screened into desired sizes and sold. Currently the market is taking all foundry coke production while running at an operating rate of 1,000 tons per day of coal charge, along with additional coke that is being reclaimed from inventory. At times when the market does not absorb all coke production it is loaded into trucks and hauled to a storage area where it is stocked until such time as it is needed. At present some 70% of coke

production is of 3 in. and over foundry quality while the remainder is smaller sizes and breeze which are sold for industrial and domestic purposes.

The gas produced from the coal carbonized is drawn from the ovens by means of exhausters located in the by-products building. This gas is cooled for the extraction of tar, ammonia solution and light oil products. Coke oven gas production is first used for underfiring of the ovens and any surplus is compressed to about ~~9~~ 7 lbs. per square inch pressure for delivery to ~~the Sewerage Commission.~~ the boiler house, the surplus delivered to the Sewerage Commission.

The Coke Company handles its own sales of domestic coke in Milwaukee County while the other sales, including foundry, furnace, industrial and domestic are handled by the Company's agent, Pickands, Mather & Company. The coal chemicals, ammoniacal liquor, benzol, toluol and xylol are sold through Nitrogen Products, Inc.

COKE OVEN GAS PRODUCTION AND SALE

The Coke Oven Gas Contract:

The Coke Oven Gas Contract of August 22, 1950, under which the Coke Company sells its coke oven gas to the Gas Company obligates the Coke Company to deliver a minimum of 60,000 therms and up to 67,000 therms if available of surplus coke oven gas a day to be paid for at a price per therm equal to the average cost of coal per therm to the Wisconsin Electric Power Company, which price has been running about 3.3¢ per therm.

The Coke Oven Gas Contract also provides that the Coke Company will maintain its producer plant and liquified petroleum gas plant in standby condition so that the Coke Company will be able to deliver during periods of emergency, a total quantity of gas up to 110,000 therms per day. For this standby service the Coke Company receives a standby fee of $100,000 annually.

The Coke Company has experienced the wide fluctuations in market conditions, characteristic of the merchant coke business. Since a merchant coke plant supplies what might be termed peak load coke requirements of the iron and steel industry, such a plant is the first to suffer a reduced market during times of reduced steel production. In addition, since the time of entering into the Coke Oven Gas Contract, the steel companies have built up coking capacity of their own to provide for over 85% of their requirements for furnace coke and accordingly, the market for furnace coke has continually decreased until today, there appears to be little

C12

Form 229

Milwaukee Solvay Coke Company

1959 Operations
Report

REPORT ON THE OPERATIONS OF

MILWAUKEE SOLVAY COKE COMPANY

Chas. R. Hetherington & Co., Ltd.

June 1959

CONTENTS

Mr Sauer
2 copies for Co.

June 10th, 1959

American Natural Gas Company
666 Penobscot Building'
Detroit 26, Michigan

Dear Sirs:

Pursuant to your request we have made a study of the operations of the Milwaukee Solvay Coke Company (hereinafter referred to as the Coke Company and of the effect of such operations on the Milwaukee Gas Light Company (hereinafter referred to as the Gas Company), for the purpose of determining (a) if the Coke Company is being operated most effectively and (b) the most desirable arrangements for the future between the Coke Company and the Gas Company.

This study was made with the assistance of Mr. A.C. Sedlachek, Manager of the Everett Massachusetts Works and Mr. F.D. Miller, Superintendent of the Philadelphia Coke Division, both of Eastern Gas and Fuel Associates. Visits were made to the Milwaukee plant and down town office for the purpose of inspecting plant facilities and analyzing plant operating data and costs.

The Coke Company has been in operation for over fifty years and much of the equipment is very old and could not economically be replaced under present conditions. While the merchant coke industry is a declining industry the Coke Company is favorably situated with respect to markets at the present time and can be expected to continue profitable operation by affecting all possible economies. The Coke Company has been generally well managed and with the exception of the commitment to supply a minimum of 60,000 therms per day of coke oven gas for use by the Sewerage Commission and the continuation of the firing of natural gas and solid fuels instead of low cost coke oven gas, operating decisions have been generally sound.

Following are our conclusions regarding the effectiveness of operation of the Coke Company and our recommendations for future operations.

(1) The commitment to deliver a minimum of 60,000 therms per day of coke oven gas for consumption by the Sewerage Commission was ill-advised. In order to produce this quantity of coke oven gas the plant would have to operate at a charging rate of 2100 tons per day with a coking time of twenty-three hours, which condition is only possible when running to produce largely furnace coke. There has not been a year since entering into the Coke Oven Gas Contract that the market for furnace coke has been sufficient to permit this production. At the present operating rate of about 1000 tons per day coal charge the failure to produce the minimum contact of coke oven gas costs the Coke Company about $60,000 annually.

(1) (2) The remaining principal market available to the Coke Company is the market for high quality foundry coke. Production of this product requires coking times of at least thirty hours which limits plant capacity to a maximum of 1600 tons per day of coal charge. The Coke Company anticipates that markets will require increasing the present operating rate from 1000 to 1350 tons per day. The surplus coke oven gas available at these three operating rates if the gas is not fired in the boiler or if it is fired with and without electric power generation is as follows:

	Average Daily Therms of Coke Oven Gas for Daily Operating Rates of:		
	1000 Tons	1350 Tons	1600 Tons
Surplus if Not Fired	23,600	32,400	42,700
Surplus if Fired with Electric Generation	300	5,700	14,200
Surplus if Fired With Power Purchased	6,150	12,200	21,300

The production of coke oven gas measured in therms per day per ton of coal carbonized is comparable to that obtained by other plants in the industry so that the failure fo make the contemplated volume of surplus coke oven gas is the result of lower coal throughput and not of lower plant efficiency. The report gives a tabulation of the surplus coke oven gas that can be expected by months for the above operating rates and for various conditions of boiler firing and electric power generation.

(3) Actual costs of maintaining the producer and petroleum plants in standby condition are estimated at $32,500 so that the Coke Company profits from the $100,000 standby fee under the Coke Oven Gas Contract.

(2) (4) Operating practices other than fuels used for firing the boilers are generally good.

(a) The present method of operating all batteries at longer coking times is preferable to banking one of the batteries and pushing the others at shorter coking times.

(b) Coke yield is good approaching 80% of coal charged, and the yield of the larger sized foundry and furnace coke is good, in the range of 72%, further indicating the quality of operation.

(c) The practice of using two shifts with some overtime at the present low throughput results in a monthly dollar saving over the use of three shift operation.

(d) In addition to some $5,500 annually of standby or idle time in the producer and petroleum plants it is indicated that some labor saving could be effected by consolidating certain foreman and assistant foreman classifications. It is estimated that a maximum of fifteen employees might be affected.

(e) The agreements with union labor are as good or better than those of other plants in the industry.

(f) The supervisory personnel at the plant are capable and experienced men doing a creditable job.

(g) By-product coal chemical yields are somewhat below industry average and the economics of recovery is only slightly profitable to marginal. The principal by-product prices are dropping and as the market for these by-products changes further and as major maintenance expenditures or capital additions are required, the economic desirability of continuing by-product recovery should be reviewed.

(5) The Coke Company should stop firing all solid fuels and natural gas and fire its own coke oven gas in the boilers. Rather than selling coke oven gas at the present prices paid by the Sewerage Commission or even at the heat equivalent price of natural gas delivered by Michigan Wisconsin the Coke Company should have been burning its own coke oven gas. Natural gas at the gas company's Special Industrial rate schedule is more costly than coke oven gas. Because of the high costs of handling and maintenance of equipment the cost of solid fuels is much more expensive than coke oven gas. It is estimated that the firing of coke oven gas can save $183,000 annually over the present method of burning natural gas and solid fuels. Boiler conversion to permit firing with 100% coke oven gas with provisions for natural gas and solid fuel standby is estimated at $60,000 which will pay out of savings after income taxes in less than one year.

(3) (6) The saving by purchasing electric power rather than generating it is not sufficient to give an attractive pay out of the required investment in rectifier equipment to permit purchasing electric power. Instead of going to purchased power at this time it is believed that the motor generator set should be operated at its maximum continuous load capabilities (instead of for peak load) so as to produce a maximum amount of power and minimize the amount generated. With this method of operation a saving in boiler house costs will be realized without any added capital investment.

(4) (7) From observation of plant condition it is indicated that if operation is to be continued for more than a few years an additional expenditure of about 60¢ per ton of coal carbonized or $250,000 annually will be required for maintenance in excess of the amount planned to be spent.

The Gas Company has entered into a new contract with the Sewerage Commission as of May 1st, 1959 (subject to approval of the Wisconsin Public Service Commission) which, upon approval, will terminate the old contract. This new contract will place the Sewerage Commission on a large volume rate schedule pricing heat units irrespective of the type of gas

supplied so that there will no longer be any necessity to charge the Coke Company for the added cost of natural gas used to make up deficiencies in coke oven gas production below 60,000 therms per day.

The Gas Company proposes to ride out the Coke Oven Gas Contract until it terminates September 1, 1960 under which it pays the contract price amounting to about 3.3¢ per therm of coke oven gas plus the annual standby fee of $100,000. After the Coke Oven Gas Contract expires the Gas Company proposes to buy surplus coke oven gas without a contract in the quantities and at the times that it is available at the heat equivalent of natural gas received from Michigan Wisconsin which is presently 3.75¢ per therm. The Gas Company does not propose to renew the standby arrangement.

Following are our conclusions regarding the most desirable arrangements for the future between the Coke Company and the Gas Company.

(1) By continuing the Coke Oven Gas Contract until its natural termination in September, 1960, the Coke Company will receive a lower price for its gas but this loss estimated at about $15,000 represents a gain of the same amount to the Gas Company. The continuation of the standby fee is estimated to benefit the Coke Company some $67,500 annually over its actual costs.

(2) If the two part rate proposal of Michigan Wisconsin is not approved and the Gas Company is faced with curtailing the attachment of space heating customers during the forthcoming heating season, it would be desirable to use coke oven gas to permit continued attachment of space heating customers rather than place any further impediments in the way of the nicely-growing space heating business.

(3) If the Coke Company plant is operated at the expected rate of 1350 tons of coal charge per day producing 32,400 therms per day, a maximum of some 2300 space heating customers could be supplied. Each space heating customer is worth about $93 annually to the Gas Company. The cost of purchasing natural gas to make coke oven gas available for this purpose would be about $17 annually so that the net benefit to the American Natural Gas System would be some $76 a year per space heating customer supplied with coke oven gas.

(4) Because of the severe penalty provision of the Michigan Wisconsin tariff it is important not to take on any more excess space heating customers than can be supplied each month with coke oven gas. The Coke Company plans to be at the 1350 ton per day operating rate by September and if this plan materializes and if conditions at that time indicate continued coking at this rate during the winter, it would appear reasonable to take on up to about 2000 excess space heating customers. Added gross profit from this source to the American Natural Gas System could amount to $150,000 during the next year.

(5) It is indicated that Michigan Wisconsin will be able to keep its Special Industrial customers on the line during the 1959-60 heating season so that natural gas purchases to replace coke oven gas in the boilers may not be interrupted. In case of interruptions the Coke Company can fire solid fuels at increased costs.

(6) The prospects for additional gas after the 1959-60 season are believed to be sufficiently good so that the Gas Company should not be getting into a position in which it would have to rely upon coke oven gas after the 1959-60 season.

(7) After the termination of the Coke Oven Gas Contract in September, 1960 the Coke Company should continue to fire the maximum amount of coke oven gas in its boilers to generate its steam requirements and sell surplus gas when and in the volumes available from time to time. The Coke Company might make such a sale to the Gas Company or it might make an arrangement directly with the Sewerage Commission at a better price.

(5) ~~(8)~~ The present natural gas connection should be maintained to provide make up fuel during periods of deficient coke oven gas production, and to provide natural gas for fuel when coke oven gas is being sold to the Gas Company for space heating purposes.

The report upon which the above conclusions and recommendations are based is attached.

Very truly yours,

Chas. R. Hetherington & Co. Ltd.

Chas. R. Hetherington

SECTION 1

THE OPERATIONS OF

THE MILWAUKEE SOLVAY COKE COMPANY

REPORT ON THE OPERATIONS
OF MILWAUKEE SOLVAY COKE COMPANY

June 1, 1959

INTRODUCTION

The Milwaukee Solvay Coke Company (hereinafter referred to as the Coke Company), a subsidiary of the American Natural Gas Company system and thereby an affiliate of the Milwaukee Gas Light Company (hereinafter referred to as the Gas Company), owns a merchant coke plant located on deep water within the City of Milwaukee, Wisconsin, for the production of coke, coke oven gas and coal chemicals. Coke oven gas is sold to the Gas Company and, prior to the advent of natural gas in 1949, was a principal source of gas supply for the Gas Company. The Coke Company has been in operation for over 50 years and the management has had to alter its operations and policies to meet a wide variety of varying conditions over the years.

With the advent of natural gas to Milwaukee, supplied by Michigan Wisconsin Pipe Line Company (hereinafter referred to as Michigan Wisconsin, also a subsidiary of the American Natural Gas Company system), the Gas Company in its desire to avoid the distribution of mixed coke oven and natural gas worked out a ten-year arrangement to sell all of the coke oven gas produced by the Coke Company to the Sewerage Commission of the City of Milwaukee, (hereinafter referred to as the Sewerage Commission). A companion contract was entered into between the Coke

Company and the Gas Company (hereinafter referred to as the Coke Oven Gas Contract) for the sale of the coke oven gas to the Gas Company.

Various difficulties have arisen in operating under the Coke Oven Gas Contract and the contract with the Sewerage Commission, and recently the Gas Company has negotiated a more favorable agreement with the Sewerage Commission which will become effective and terminate the old contract as of May 1, 1959, subject to the approval of the Public Service Commission of Wisconsin. The Coke Oven Gas Contract will terminate on September 1, 1960, pursuant to notice given as provided in the contract.

A study has been made of the operations of the Coke Company and of the effect of such operations on the Gas Company to determine (a) if the Coke Company is being operated most effectively, and (b) the most desirable arrangements for the future between the Coke Company and the Gas Company, both until the termination of the Coke Oven Gas Contract in 1960, and thereafter. This report is divided into two sections, dealing with these matters as follows:

<u>Section 1:</u> The Operations of The Milwaukee Solvay Coke Company.

<u>Section 2:</u> The Future Sale of Coke Oven Gas Between The Coke Company and The Gas Company.

Section 1 deals with the following principal subjects:

1. The Coke Company Plant.
2. Coke Oven Gas Production and Sale
   - (a) The Coke Oven Gas Contract
   - (b) Coke Oven Gas Yield
   - (c) Economics of Standby Operation
3. Other Plant Operations
   - (a) Operating Practices
   - (b) By-Product Yields
   - (c) Firing Alternate Fuels and Power Generation
4. Maintenance and Plant Condition

Conclusions and recommendations are summarized in the letter of transmittal for this report.

THE COKE COMPANY PLANT

The Coke Company plant is located at 311 East Greenfield Avenue on 41.8 acres of land fronting on deep water of the Kinnickinnic River, providing access to Great Lakes and ocean shipping. The plant is served by the Chicago, Milwaukee, St. Paul and Pacific Railway; the Milwaukee, Chicago and Northwestern Railway; and the Chesapeake and Ohio Railway car ferry. A layout of the plant is shown in the attached Plot Plan.

The coking facilities consist of 200 ovens in four batteries. Two of the batteries are of the Solvay type with 40 ovens in one battery and 60 in the other. The other two batteries are of the Koppers type with 50 ovens each. The Koppers ovens are 17-inch ovens with some 30 feet long while the Solvay ovens are 17-inch ovens some 36 feet long, each with a nominal coal charge capacity of eleven tons at a bulk density of 50 pounds per cubic foot. Actual coal charge is about ten tons per oven or 2,000 tons for the plant of 200 ovens. The nominal capacity of the plant is about 2,000 tons per day of coal charge to produce 1600 tons per day of furnace, foundry and other cokes. When operating on foundry coke the plant capacity is 1600 tons per day of coal charge.

The Koppers ovens are equipped with heat regenerators, while the Solvay ovens use recuperative heat recovery in by-product steam generators. The ovens have compound firing and, although coke oven gas is normally fired, the Koppers ovens can

be fired with producer gas while the Solvay ovens can be fired with petroleum-enriched producer gas. There is a producer gas plant with a capacity of 38,000 therms per day and a liquified petroleum gas plant with a capacity of 14,400 therms per day, making a total gas generating capacity of 52,400 therms daily.

The plant is equipped with screens and crushers to provide the sizes desired for foundry and furnace use and the smaller egg, stove, nut, range, pea and breeze.

The gas recovery system consists of facilities to remove and recover crude tar including naphthalene, an ammoniacal water solution which is concentrated to 26% ammonia and light oils which are fractionated into benzol, toluol and mixed xylols. Neither pyridine nor sulphur are recovered. Waste liquor is disposed of to the Sewerage Commission and sulphur is left in the coke oven gas.

The boiler plant consists of eight boilers with a total capacity of 4,000 boiler horsepower, two of which are converted for the firing of gas as well as solid fuels. also 2 are convertible to gas [illegible] The power plant consists of ~~four~~ three steam engine driven generators, two steam turbine driven generators and a motor generator set with a combined capacity of ~~3,100~~ 2,100 kilowatts of direct current.

The plant is complete with other appurtenant facilities, such as gas holders, gas compressors to transfer the coke oven gas and a water system from the river to provide cooling water and fire protection. As noted on the Plot Plan, the plant site is provided with ample dockage, railway spurs and a 480 foot coal stacking and reclaiming bridge.

The plant, out of necessity due to its age, is equipped with machine shop, pipe shop and other services required to keep the equipment in operation. A railroad system is employed throughout the plant to handle coke movement except for storage and reclaiming of coke which is done by truck.

Coal is received at the plant from April 1st to December 15th and is stacked in individual piles and impacted to protect against spontaneous combustion. Daily needs of coal for processing are transferred from the stock piles by conveyor belt and are proportioned as required by the mix being coked. The coal is weighed, mixed and crushed and then conveyed to the coke oven bins from whence it is charged to the oven chambers by overhead cars.

At present foundry coke is screened into desired sizes and sold. Currently the market is taking all foundry coke production while running at an operating rate of 1,000 tons per day of coal charge, along with additional coke that is being reclaimed from inventory. At times when the market does not absorb all coke production it is loaded into trucks and hauled to a storage area where it is stocked until such time as it is needed. At present some 70% of coke

production is of 3 in. and over foundry quality while the remainder is smaller sizes and breeze which are sold for industrial and domestic purposes.

The gas produced from the coal carbonized is drawn from the ovens by means of exhausters located in the by-products building. This gas is cooled for the extraction of tar, ammonia solution and light oil products. Coke oven gas production is first used for underfiring of the ovens and any surplus is compressed to about ~~9~~ 7 lbs. per square inch pressure for delivery to ~~the Sewerage Commission~~. the boiler house, the surplus delivered to the Sewerage Commission.

The Coke Company handles its own sales of domestic coke in Milwaukee County while the other sales, including foundry, furnace, industrial and domestic are handled by the Company's agent, Pickands, Mather & Company. The coal chemicals, ammoniacal liquor, benzol, toluol and xylol are sold through Nitrogen Products, Inc.

COKE OVEN GAS PRODUCTION AND SALE

The Coke Oven Gas Contract:

The Coke Oven Gas Contract of August 22, 1950, under which the Coke Company sells its coke oven gas to the Gas Company obligates the Coke Company to deliver a minimum of 60,000 therms and up to 67,000 therms if available of surplus coke oven gas a day to be paid for at a price per therm equal to the average cost of coal per therm to the Wisconsin Electric Power Company, which price has been running about 3.3¢ per therm.

The Coke Oven Gas Contract also provides that the Coke Company will maintain its producer plant and liquified petroleum gas plant in standby condition so that the Coke Company will be able to deliver during periods of emergency, a total quantity of gas up to 110,000 therms per day. For this standby service the Coke Company receives a standby fee of $100,000 annually.

The Coke Company has experienced the wide fluctuations in market conditions, characteristic of the merchant coke business. Since a merchant coke plant supplies what might be termed peak load coke requirements of the iron and steel industry, such a plant is the first to suffer a reduced market during times of reduced steel production. In addition, since the time of entering into the Coke Oven Gas Contract, the steel companies have built up coking capacity of their own to provide for over 85% of their requirements for furnace coke and accordingly, the market for furnace coke has continually decreased until today, there appears to be little

expectation of any substantial market for this grade of coke, except in case of a national emergency.

The following tabulation indicates the trend in coke sales volume and distribution:

	Year	Annual Sales Tons Furnace	Foundry	Other	Total	Per cent Furnace Coke
	1950	147,622	223,470	141,005	512,097	43.6%
	1951	208,377	236,962	83,003	528,342	39.4
	1952	191,987	227,304	80,825	500,116	38.4
	1953	261,241	214,638	73,330	549,209	47.8
	1954	-	177,442	61,999	239,441	0.0
	1955	170,833	265,539	66,998	503,370	33.9
	1956	57,060	249,555	78,678	385,293	14.8
	1957	94,632	198,959	72,501	366,092	25.9
	1958	33,876	172,022	62,263	268,161	12.6
(3 months)	1959	-	60,483	17,813	78,296	0.0

The Coke Company, then has as a necessity been concentrating on the foundry business and hopes to build its foundry coke sales back to the 250,000 ton level of the better years of the last decade.

With reduced coke production and operation on foundry coke, the Coke Company has been unable to produce the minimum contracted quantity of 60,000 therms per day of coke oven gas. Under the agreement between the Gas Company and the Sewerage Commission for the sale of the coke oven gas, the Gas Company has been required to make up this deficiency in coke oven gas by supplying higher cost natural gas, and since the Gas Company has sustained damages, it has had to enforce the minimum delivery

provisions of the Coke Oven Gas Contract and charge the Coke Company with the added cost of supplying natural gas which presently costs about 3.75¢ per therm. At present production rates of 23,000 therms per day this added charge is costing the Coke Company about $60,000 annually (37,000 therms deficiency x 365 days x $0.0045).

The Gas Company has entered into a new contract with the Sewerage Commission as of May 1, 1959 (subject to approval of the Wisconsin Public Service Commission) which, upon such approval, will terminate the old contract. This new contract will place the Sewerage Commission on a large volume rate schedule pricing heat units irrespective of the type of gas supplied so that there will no longer be any necessity to charge the Coke Company for the added cost of natural gas used to make up deficiencies in coke oven gas production below 60,000 therms per day.

The Gas Company proposes to ride out the Coke Oven Gas Contract until it terminates September 1, 1960, under which it pays the contract price amounting to about 3.3¢ per therm plus the annual standby fee of $100,000.

After the Coke Oven Gas Contract expires, the Gas Company proposes to buy surplus coke oven gas without a contract in the quantities and at the times that it is available at the heat equivalent of natural gas received from Michigan Wisconsin which is presently 3.75¢ per therm. The Gas Company does not propose to renew the standby arrangement.

Coke Oven Gas Yield:

The shift from furnace to foundry coke has required a shift in operation. While furnace and domestic coke can be produced with a coking time as short as 17 hours, high quality foundry coke requires a coking time of about 30 hours. Since plant capacity is reduced in inverse proportion to the coking time, maximum plant capacity producing foundry coke is 1600 tons per day of coal charge.

The Coke Company operates all of its ovens at all times regardless of the amount of production desired and regulates the amount of production by adjusting the coking time. Accordingly, the coking time is set by the amount of production desired and not by quality requirements other than for the minimum coking time needed to produce quality foundry coke. For this type of operation with an average coal charge of 2,000 ton the daily coke production is related to coking time as follows:

C = Coal Charge in Tons per day

T = Coking Time in Hours

$$C = \frac{2000 \times 24}{T} = \frac{48,000}{T}$$

The attached Chart No. 1 shows actual plant coal charge for various coking times. Over the past ten years the average coking time has been increased from about 24 hours to 48 hours.

Since the production of coke oven gas from a charge declines rapidly after about 20 hours, while the requirements for coke oven gas for underfiring fuel continues for the full period of coking, the net production of coke oven gas is less at longer coking times. Radiation heat losses from the ovens and the impracticability of continuously adjusting the firing to individual ovens results in increased consumption of coke oven gas with increased coking time. Further, the longer coking times give more time for flue gas to leak into the ovens which dilutes the coke oven gas with carbon dioxide and nitrogen thereby reducing the heat content per cubic foot.

The attached Table No. 1 shows by months the coal charge by types and times of coking time along with surplus coke oven gas production, heat content and specific gravity. The attached Chart No. 2 based upon these data shows the decline in net coke oven gas production and the decline in heating value with increases in coking time for the plant.

The attached Table No. 2 shows how the composition of the coke oven gas varies with coking time. The effect of flue gas leakage is indicated by the substantial increase in nitrogen content for the longer coking time.

In order to produce the minimum quantity of coke oven gas of 60,000 therms per day, specified in the Coke Oven Gas Contract, the plant would have to operate on a 23-hour coking time charging 2100 tons of coal per day. At this condition

the net coke oven gas production would be 28 therms per ton which is comparable to the production obtained by other plants in the industry. This condition is only possible when running to produce a substantial tonnage of furnace coke and there has not been a year since entering into the Coke Oven Gas Contract that the market for furnace coke has been sufficient to permit production of 60,000 therms per day of coke oven gas.

At present operating rates of about 1000 tons per day with a 48-hour coking time, the plant produces about 23,600 therms per day of net coke oven gas or 23.5 therms per ton.

The Coke Company anticipates markets which will require running at an operating rate of 1350 tons daily, starting in September, and at this rate the coking time would be 36 hours and gas production would be about 32,400 therms per day. At the maximum capacity of the plant when running for foundry coke of 1600 tons per day of coal charge with a coking time of 30 hours, the maximum coke oven gas production that can be expected is about 42,700 therms per day.

The amount of this coke oven gas that would be available for sale depends upon whether the gas is fired in the boilers and whether electric power is generated or purchased.

The following tabulation gives the reductions that could be made at three plant operating rates in the amount of power generated, steam produced, and gas fuel fired by purchasing power.

Operating Rate - Tons per Day Coal	1000	1350	1600
Annual Power Requirement - KWH	7,350,000	7,960,000	8,390,000
Less Power Purchased - KWH	2,000,000	2,000,000	2,000,000
Power Presently Generated - KWH	5,350,000	5,960,000	6,390,000
Possible Reduction in Generation-KWH (1)	4,750,000	5,360,000	5,790,000
Increase in Power Purchased-KWH (2)	5,280,000	5,950,000	6,430,000
Annual Reduction in Steam if Power is purchased - M. lb.	150,000	167,000	184,000
Annual Reduction in gas Fired if Power is purchased - Therms	2,130,500	2,370,600	2,608,800

Note (1) - Some 600,000 KWH annually can be generated on surplus process steam during times when the ammonia concentration plant is down, and would not require purchase.

(2) - Increase in power purchased is greater than the reduction in power generated because of 90% rectifier efficiency.

The attached Table No. 3 gives an estimate of the net surplus coke oven gas that will be available by months at three operating rates of 1000, 1350 and 1600 tons of coal charge per day if (a) coke oven gas is not fired in the boilers, (b) if coke oven gas is fired and electric power is generated, and (c) if coke oven gas is fired and electric power is purchased. The average day net surplus coke oven gas available under these conditions is summarized as follows:

	Average Daily Therms of Coke Oven Gas for Daily Operating Rates of:		
	1000 tons	1350 tons	1600 Tons
Surplus if Not Fired	23,600	32,400	42,700
Surplus if Fired with Electric Generation	300	5,700	14,200
Surplus if Fired with Power Purchased	6,150	12,200	21,300

While there is a net surplus of coke oven gas production over a year there would not be sufficient gas during the five winter months to meet all boiler fuel requirements when operating at the 1000 ton per day coal charge rate and producing power. These monthly deficiencies are shown in attached Table No. 3. The source of natural gas supply to the plant should be maintained to provide make up fuel during such periods of deficiency in coke oven gas for firing and for emergency purposes.

Economics of Standby Operation:

On the books of the Coke Company the Producer and Petroleum Plants are charged with actual cost expended on the plants and with an allocation of costs of other departments. The attached Table No. 4 gives a statement of costs for the year 1958 which were charged to the Producer and Petroleum Plants on the books along with an estimate of the actual cash costs that would not be incurred if the plants were dismantled.

(13)

Out of the $84,035 charged to the plants on the books only about $32,500 would be actually saved by abandoning the facilities. About two-thirds of saving would be in property taxes and insurance.

Part of the time of certain supervisory and operating personnel (1/2 to 2 hours per day) is charged to the plants. Abandonment of these facilities would save this time but there would not be any reduction in costs. Similarly, there would be certain savings of repair labor fractional hours but no personnel would be eliminated.

Eight operating personnel receive from 10¢ to 49¢ per hour above certain base rates for standing ready to operate these plants and an engineer devotes a substantial portion of his time to these plants. These costs amounting to $5,550 annually which are carried under "idle time" would be saved by abandoning the facilities.

Certain operating supplies, repair materials and a portion of the allocated costs of the service departments would be saved. Depreciation is not an item of saving since any remaining book value of the facilities not depreciated when the plants are abandoned and dismantled ($82,963 as of December 31, 1958) would be charged against surplus as an abandonment loss.

Since the major part of the labor expense is on a part-time fractional hour basis so that these employees would not be eliminated and since certain allocated costs of other departments would not actually be saved, the actual cost attributable to the Producer and Petroleum Plants is about $32,500 annually. The Coke Company profits from the $100,000 standby fee.

OTHER PLANT OPERATIONS

Operating Practices:

The plant is operated so that desired throughput is obtained by adjusting the coking time. At the lower throughputs and longer coking times coke oven gas yields are reduced and carbon which normally seals the refractory is burned out of the ovens so that flue gas leaks into the coke oven gas (see Chart No. 2 for effect upon BTU content). Consideration was given to the economics and practability of banking one battery of ovens so that the remaining three batteries could be operated on a faster coking schedule. Decreasing the coking time would improve coke oven gas yield and would increase carbon on the walls of the ovens.

Fuel required to bank the one oven battery shut down would be about 10% of that required for coking and hence a substantial volume of fuel would be used to keep the battery warm. No saving is made in man power since the same number of ovens must be pushed in a given period and the increase in coke oven gas production is offset by the fuel required to keep the one battery warm. While more frequent pushing of the ovens in operation, maintenance expenses would be expected to increase and accordingly it is indicated that the present method of operation is to be preferred.

It is suggested that the operators of the plant experiment to produce foundry coke pushing warmer without changing its quality in an effort to seal the walls of the ovens more effectively with carbon.

With the procedures employed at the plant a good coke yield approaching 80% of coal charged has been consistently obtained. This yield is above industry average. Coke quality also has been above that of the general industry and the yields of the larger sized foundry and furnace coke have been good, in the range of 72%, further indicating the quality of operation. Attached Table No. 5 shows the production of coke from coal and the production of the larger foundry and furnace cokes out of total coke produced.

At the present throughput of about 1000 tons per day with a coking time of 48 hours, the operating forces have been reduced to two shifts per day. Attached Table No. 6 gives the cost for operating labor with two shifts as compared to three for the present operating rate. Only the operation of the ovens and coke handling are affected by this type of operation. By using two shifts instead of three there is a reduction of twelve jobs and a monthly saving of $6,700 in direct labor costs exclusive of fringe benefits.

In addition to selling current production the plant is presently reclaiming foundry coke from stock to meet market requirements and certain of the personnel are worked overtime in connection with the reclaiming operation. Attached Table No. 7 gives

the cost of labor for the coke handling department for this two shift operation with overtime as compared to three shift operation which shows a direct labor saving exclusive of fringe benefits of some $3,800 a month.

Operation with two shifts does not necessarily of itself entail additional overtime work. The temporary reclaiming of coke from stockpile results in some overtime being paid to men who work on the two shift basis. During the first three months of 1959 overtime was also paid to men working on the rush completion of crushing and screening apparatus. Table No. 8 gives an analysis of man hours and cost for operation and maintenance for the year 1957 during which three shifts were worked and for the year 1958 during which two shifts were worked. During 1957 with three shifts, overtime pay ran about $4,300 per month or about 10¢ per ton of coal charged. During 1958 with two shifts, overtime ran about $2,500 per month or about 9¢ per ton of coal charged. Plant operating statistics do not indicate any excessive overtime as a result of the two shift operation and, in fact, indicate a reduction.

For low operating rates the two shift method of operation results in reduced labor costs and accordingly is desirable. The Company has been on a two shift basis since January, 1958 and at the present time proposes to continue to operate on this basis until capacity is increased to 1,350 tons per day in September of 1959, at which time it is planned to resume three shift operation.

In addition to the some $5,500 annually of standby or idle time as described in the previous section of this report under "Economics of Standby Operation", there appears to be a possibility of effecting further labor savings by consolidating certain of the foreman and assistant foreman job classifications. In other plants which have effected similar economies the duties being performed by some fifteen employees of this class have been consolidated to reduce the number of supervisory personnel.

The labor agreements between the Coke Company and the Unions is a better than average contract in the industry. Wage scales are not out of line and, in fact, are lower than in many plants, and operating restrictions though bothersome are not as severe as in other similar contracts in the industry.

The supervisory personnel at the plant are capable and experienced men doing a creditable job.

By-Product Yields:

While the yield of coke from coal is exceptionally good (in the range of 80%), the yield of coal chemicals from the antiquated recovery system is somewhat less than would be expected from the average coke plant. Comparative yields of coal chemicals are as follows:

	Coal Chemical Yields per Ton of Coal Coked	
	Coke Company Plant	Average Industry
Tar	6.9 Gallons	7.4 Gallons
Ammonia	3.9 Pounds	6.5 Pounds
Aromatics	2.3 Gallons	2.9 Gallons

Part of the lower by-product yield, particularly in the case of ammonia is the result of the higher percentage of low volatile coal used in the manufacture of foundry coke, while the remainder is the result of low efficiency of the recovery equipment.

The revenue from these by-products though substantial in dollar amount is a relatively small proportion of total revenue as indicated by the following revenue figures, and the Coke Company has not felt justified in the face of decreasing by-product prices in revamping, or in cases, repairing recovery equipment.

	Year	Revenue from Coal Chemicals	Total Revenue	Per Cent of Revenue from Coal Chemicals
	1952	$ 1,123,798	$ 11,849,903	9.5%
	1953	1,144,982	13,189,828	8.7
	1954	636,849	6,335,250	10.0
	1955	862,265	11,855,494	7.3
	1956	878,355	10,501,104	8.4
	1957	834,335	10,271,107	8.1
	1958	582,509	7,678,566	7.6
(3 months)	1959	138,800	2,387,777	5.8

The economics of by-product recovery were reviewed and based on actual costs it is indicated that recovery is only slightly profitable to marginal. On the basis of costs actually incurred and allocated against the recovery units the recovery operations would not appear economic, however, the abandonment of these operations would not result in the saving of the book costs that are presently charged to the operations.

In the case of light oil recovery the gas must be cleaned of naphthaline to prevent plugging in gas mains and accordingly certain minimum expenditures are required. In the case of ammonia the recovery unit could be shut down if it were desired, and the ammonia liquor diverted to the sewage plant as has been done in the past during periods of downtime on the ammonia recovery unit.

The trend in prices obtained for by-product coal chemicals is shown in Attached Table No. 9. Since 1952 the price of tar and ammonia has increased while the price of light oils has decreased markedly. As the market for these by-products changes and as major maintenance expenditures or capital additions to the by-product recovery system are required an analysis should be made to determine the economic desirability of continuing by-product recovery.

FIRING ALTERNATE FUELS AND POWER GENERATION

The boiler house is equipped with 4- 600 HP and 4 - 400 HP boilers presently equipped for firing fuels as follows:

Boiler Number	Boiler Horsepower	Fuel
1	600	Gas or Coal
2	600	Gas or Coal
3	600	Coke
4	600	Coke Breeze and Coal
5	400	Coke Breeze and Coal
6	400	Coal
7	400	Coke Breeze and Coal
8	400	Coal

In the past there has been little market for coke breeze, and this material has been mixed with 25 to 30 per cent coal and fired for steam generation. Coal and natural gas have been used to make up the remaining heat requirements.

Coke breeze has been valued at its heating value of about 5/6 of that of coal or $6.17 per ton. Recently, a good and apparently continuing market is developing for coke breeze at about $8.00 per ton for use in the benefaction of taconite iron ores, and accordingly coke breeze has a greater value for sale than for fuel. The Coke Company has gradually been reducing the tonnage of coke breeze and coal fired and has replaced these fuels with natural gas. Presently, no coke breeze is being fired.

While coke oven gas has a sales value of about 3.3¢ per therm, any of this gas used in the past has had to be replaced by natural gas at Michigan Wisconsin prices (presently 3.75¢ per therm) for delivery to the Sewerage Commission. Accordingly, coke oven gas has had a value to the Coke Company of 3.75¢ per therm. It is difficult to underatand why the Coke Company would buy natural gas at 4.7¢ per therm when it could burn its coke oven gas at 3.75¢ per therm.

Now that the Coke Company is not to be required to pay increased natural gas prices for coke oven gas production below 60,000 therms per day, coke oven gas has a lower value of 3.3¢ per therm and there is even more advantage to firing coke oven gas instead of natural gas.

Solid Fuels vs. Gas: As previously noted the Coke Company is presently firing coal and natural gas. In order to indicate the relative economics of firing various fuels, the actual plant costs which vary with the type of fuel used have been analyzed. Since the amount of steam generated, and hence costs, depend upon whether electric power is generated or purchased, these costs which vary with the type of fuel fired have been considered both for generating and for purchasing electric power along with the costs which vary with the generation or purchase of power.

The attached Table No. 10 gives a comparison of the costs which vary with the type of fuel fired and with electric generation for (a) the firing of solid fuels only, (b) the firing of both solid fuels and natural gas and (c) the firing of gas only at various prices, all for the anticipated operating rate of 1350 tons per day of coal charge.

The quantity of steam, electric power and fuel required are shown at the top of the table. Steam and total power requirements are taken from plant operating data since 1952 as shown on attached Chart No. 3. Recently about 2,000,000 KWH have been purchased annually, and this quantity was taken as the amount to be purchased if electric generation is to be continued. If electric power is to be purchased it is estimated that surplus steam will be available on weekends when the ammonia concentration plant is down, to generate 600,000 KWH annually and purchased power would be reduced by this amount.

Fuel requirements to generate steam in the existing boiler equipment are taken at the following plant experience figures:

Fuel	Steam Generated
Coke Breeze	10,000 lbs. per ton
Coal	12,000 lbs. per ton
Gas	70.5 lbs. per therm

The costs which vary with the type of fuel fired are the fuel cost and the cost of boiler house operation and repair. Fuels are taken at their present values of $7.40 per ton for coal (and coke equivalent), 3.3¢ per therm for coke oven gas and 4.7¢ per therm for natural gas. In the columns dealing with gas firing the total costs are also shown for gas values of 3.75¢ and 4.7¢ per therm. Boiler house incremental operating and repair costs are taken from plant experience as shown on attached Chart No. 4.

The costs which vary with electric generation are the cost of power and power house incremental costs. Electric power at present consumption levels costs about 1.7¢ per KWH. The Wisconsin Electric Power Company prepared an estimate of 1.4¢ per KWH for purchase of full plant requirements. Power house incremental costs are taken from recent experience.

The costs which vary with the type of fuel fired and with electric generation are summarized from Table No. 10 as follows:

	Annual Variable Costs	
	When Generating Power	For Purchasing Power
Solid Fuel Firing	$ 612,000	$ 539,000
Solid Fuel and Natural Gas Firing	561,000	495,000
Gas Firing for Gas @ 3.3¢ per therm	378,000	356,000
@ 3.75% per therm	425,000	389,000
@ 4.7¢ per therm	514,000	459,000

In order to fire coke oven gas it will be necessary to change the orifice sizes in the burners in Numbers 1 and 2 boilers and install gas burners in Numbers 3 and 4 boilers. The estimated costs of this conversion including the removal of the stokers in Numbers 3 and 4 is $60,000.

The payout of this conversion cost by firing coke oven gas instead of solid fuels and natural gas is very attractive as follows:

	With Power Generation	For Purchasing Power
Variable Costs from Table No. 10:		
For Firing Solid Fuels and Natural Gas at present	$ 561,000	$ 495,000
For Firing Coke Oven Gas at 3.3¢ per Therm	378,000	356,000
Gross Saving	183,000	139,000
Less Income Taxes	96,000	72,000
Net Saving	$ 87,000	$ 67,000
Conversion:		
Cost	$ 60,000	$ 60,000
Payout	0.7 years	0.9 years

Since the payout is prior to the termination of the Coke Oven Gas Contract, a price of 3.3¢ per therm is taken for coke oven gas.

It is quite clear that the Coke Company should stop firing all solid fuels and natural gas and fire its own coke oven gas, whether or not electric power is generated or purchased. Savings over the present method of operation are estimated at $183,000 annually and at $139,000 annually if electric power is purchased.

Power Generation vs. Purchase: The power house is equipped with very old equipment to produce 250 volt D.C. power as follows:

Generator Number	KW	Drive	Energy Source
1	200	Engine	150 lb. Steam Exhausting to 150 or 3 lb.
2	200	Engine	150 lb. Steam Exhausting to 150 or 3 lb.
3	200	Engine	150 lb. Steam Exhausting to 150 or 3 lb.
4	(a)	Engine	150 lb. Steam Exhausting to 150 or 3 lb.
5	600	Turbine	150 or 3 lb. Steam Condensing
6	600	Turbine	150 or 3 lb. Steam Condensing
7	1000	Motor-Generator	Purchased Power
Total -	2800		

Note (a) - This 300 KW unit broke down and is out of service.

Because of the ease of control the Coke Company uses the motor generator set to take the main swings on plant power requirements. Accordingly, purchased power supplies peak load requirements and minimum power is purchased.

Rectifier equipment is required to convert purchased power into D.C. for plant use. In order to meet peak load demands some 1750 KW of rectifying capacity should be provided. The cost of a 1000 KW and a 750 KW mercury arc rectifier is estimated at $200,000 installed, based on advice from Allis-Chalmers Manufacturing Company. The payout of this investment depends upon the type of fuel and its cost as shown in the following tabulation:

Variable Costs from Table No. 10:	Natural Gas and Solid Fuel Firing	Firing with Gas 3.3¢/Therm	at 3.75¢/Therm	4.7¢/Therm
With Power Generation	$ 561,000	$ 378,000	$ 425,000	$ 514,000
For Purchasing Power	495,000	356,000	389,000	459,000
Gross Saving	66,000	22,000	36,000	55,000
Less Income Tax	32,000	8,000	16,000	26,000
Net Saving	$ 34,000	$ 14,000	$ 20,000	$ 29,000
Conversion:				
Cost	$ 200,000	$ 200,000	$ 200,000	$ 200,000
Payout	5.9 years	14.2 years	10.0 years	6.9 years

The payout of the investment to permit purchasing electric power is not particularly attractive for the present operation when firing solid fuels and natural gas, and is particularly unattractive when firing coke oven gas at 3.3% per therm.

Instead of going to purchased power at this time it is believed that the motor generator set should be operated at its maximum continuous load capabilities (instead of for peak load) so as to purchase a maximum amount of power and minimize the amount generated. With this method of operation, a saving in boiler house costs will be realized without any added capital investment.

When coke oven gas is valued at the price of natural gas delivered by Michigan Wisconsin, the conversion becomes somewhat more attractive and if the advent of Canadian gas further increases the price of Michigan Wisconsin gas, and hence the value of coke oven gas, the economics of the conversion improve further. As the value of coke oven gas increases and as absolute need to replace or major repair present generating equipment arises, consideration can then be given to making the investment required to permit purchasing electric power. Other conditions at that time can also be taken into consideration.

MAINTENANCE AND PLANT CONDITION

As a matter of policy, the plant has for some time been undertaking only day to day maintenance and has deferred a substantial amount of maintenance required to keep the plant in continuing operating condition. In past years some $1,000,000 annually or about $1.40 per ton of coal charged was expended on maintenance. In recent years this has been reduced to some $500,000 annually or about $.80 per ton. This procedure has resulted in cash savings in the past.

From observations of plant condition it is indicated that if operation is to be continued for more than a few years an additional expenditure in excess of the amount planned to be spent for maintenance must be made. An additional 60¢ per ton or $250,000 annually is estimated to be required for continued operations.

The ovens themselves are of principal importance since if allowed to deteriorate their replacement could not be justified under present economic conditions. The operating management is giving careful attention to this equipment but is limiting repairs to a necessary minimum.

As stated previously herein the concentration of ammonia and the fractionation of light oil by-products is marginal and rather than maintain these facilities in top condition it is

believed desirable to continue recovery of these products until major replacement of facilities is required at which time abandonment should be considered. This same consideration applies with respect to power generation.

SECTION 2 ~~ceb~~

THE FUTURE SALE OF COKE OVEN GAS BETWEEN THE COKE COMPANY AND THE GAS COMPANY

out

PRIOR TO TERMINATION OF THE COKE OVEN GAS CONTRACT

The Gas Company plans to "ride out" the Coke Oven Gas Contract until it terminates September 1, 1960. This is a sound plan and appears to be the best arrangement possible, both for the Coke Company and for the American Natural Gas Company system. Under the new arrangement between the Gas Company and the Sewerage Commission in which there is no longer any necessity to charge the Coke Company for the added cost of natural gas used to make up deficiencies in coke oven gas production below 60,000 therms per day, the Coke Oven Gas Contract can operate to the benefit of the Coke Company regardless of the low price established for coke oven gas in this contract.

During the period until termination of the Coke Oven Gas Contract some 18 months hence, coke oven gas will be priced at the heat equivalent of coal presently about 3.3¢ per therm. If the contract were cancelled now, coke oven gas could be priced at its value equivalent to natural gas delivered by Michigan Wisconsin which is presently 3.75¢ per therm. It has been recommended previously herein that the Coke Company burn its coke oven gas under its boilers so that a minimum volume of coke oven gas would be sold. If the Coke Company sells net surplus gas in the amount of 6,000 therms per day for the next 18 months (3,300,000 therms), the loss in revenue to the Coke Company for sale at 3.3¢ per therm as against 3.75¢ per therm is only about $15,000.

Since this loss in revenue to the Coke Company represents a gain in revenue to the Gas Company there is no net effect upon the American Natural System. As previously noted herein, the actual cost of holding the producer and petroleum plants for standby is about $32,500 annually, so that net cash of some $67,500 annually or over $100,000 during the next 18 months will be obtained under the standby arrangement.

Accordingly, the Coke Company and the American Natural system will benefit during the next 18 months by keeping the Coke Oven Gas Contract in effect, until it expires.

MEMORANDUM

To: DLF

From: WTS & KKH

Date: June 21, 1996

Re: Cleveland Cliffs - Coal Gasification Process Update

The new materials acquired by the library entitled "Recovering Manufactured Gas Cleanup Costs" were helpful in providing additional insight into the gas purification process.

An oxide box was used as a final step in the gas purification process.

sc\dlf\cliff3.mem/06/21/96

CB

Coal is received at the plant from April 1st to December 15th and is stacked in individual piles and impacted to protect against spontaneous combustion. Daily needs of coal for processing are transferred from the stock piles by conveyor belt and are proportioned as required by the mix being coked. The coal is weighed, mixed and crushed and then conveyed to the coke oven bins from whence it is charged to the oven chambers by overhead cars.

At present foundry coke is screened into desired sizes and sold. Currently the market is taking all foundry coke production while running at an operating rate of 1,000 tons per day of coal charge, along with additional coke that is being reclaimed from inventory. At times when the market does not absorb all coke production it is loaded into trucks and hauled to a storage area where it is stocked until such time as it is needed. At present some 70% of coke production is of 3 in. and over foundry quality while the remainder is smaller sizes and breeze which are sold for industrial and domestic purposes

coke oven gas

The gas produced from the coal carbonized is drawn from the ovens by means of exhausters located in the by-products building. This gas is cooled for the extraction of tar, ammonia solution and light oil products. Coke oven gas production is first used for underfiring of the ovens and any surplus is compressed to about 7 lbs. per square inch pressure for delivery to the boiler house, the surplus delivered to the Sewerage Commission.

The Coke Company handles its own sales of domestic coke in Milwaukee County while the other sales, including foundry, furnace, industrial and domestic are handled by the Company's agent, Pickands, Mather & Company. The coal chemicals, ammoniacal liquor, benzol, toluol and xylol are sold through Nitrogen Products, Inc.

COKE OVEN GAS PRODUCTION AND SALE

The Coke Company has experienced the wide fluctuations in market conditions, characteristic of the merchant coke business. Since a merchant coke plant supplies what might be termed peak load coke requirements of the iron and steel industry, such a plant is the first to suffer a reduced market during times of reduced steel production. In addition, the steel companies have built up coking capacity of their own to provide for over 85% of their requirements for furnace coke and accordingly, the market for furnace coke has continually decreased until today, there appears to be little expectation of any substantial market for this grade of coke, except in case of a national emergency.

The following tabulation indicates the trend in coke sales volume and distribution:

Year	Annual Sales Tons Furnace	Foundry	Other	Total	Per cent Furnace Coke
1950	147,622	223,470	141,005	512,097	43.6%
1951	208,377	236,962	83,003	528,342	39.4
1952	191,987	227,304	80,825	500,116	38.4
1953	261,241	214,638	73,330	549,209	47.8
1954	-	177,442	61,999	239,441	0.0
1955	170,833	265,539	66,998	503,370	33.9
1956	57,060	249,555	78,678	385,293	14.8
1957	94,632	198,959	72,501	366,092	25.9
1958	33,876	172,022	62,263	268,161	12.6
1959	-	238,876	78,082	316,958	0.0
1960	-	212,418	65,528	277,946	0.0

The Coke Company, then has as a necessity been concentrating on the foundry business and hopes to build its foundry coke sales back to the 250,000 ton level of the better years of the last decade.

The Gas Company is buying the surplus coke oven gas without a contract in the quantities and at the times that it is available at the heat equivalent of the coal used by the Wisconsin Electric Power Company which presently is 3.3¢ per therm.